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No. 26—*January* 1840.

I.—*Catalogue of the Birds of the Peninsula of India, arranged according to the modern system of Classification; with brief Notes on their Habits and Geographical distribution, and description of new, doubtful and imperfectly described Species.—By* T. C. Jerdon, *Assistant Surgeon, 2d Madras Light Cavalry.*

(*Continued from No.* 25 *page* 269.)

Sub Family SYLVIANÆ.—*Small Warblers.*

Genus ORTHOTOMUS, Horsf.—*Tailor Bird.*

114.—*O. Bennettii*, Sykes.—*O. Sphenurus*, Swains. ?—*S. ruficapilla*, Hutton, J. A. S. [of Bengal, No. 22.—*S. longicauda*, Vieill. Encycl. Method. p. 456.—*S. Guzuratta*, Lath. Young bird ?—*Phootkee*, H.—*True Tailor bird.*

The long celebrated, and notorious *Tailor Bird*, about which so much was said, and, till lately, so little known, appears to have been first described accurately as such by Lieut. Hutton, in the work referred to, and his specific name should, strictly speaking, be affixed to it, but as his description has probably not been so numerously circulated as that given by Colonel Sykes, with the correct modern generic name also, it would perhaps, be more injurious than otherwise to attempt to restore its legal name, and, moreover, if priority alone was to be consulted, the name applied by Vieillot has the preference. The *S. Sutoria* of

Latham is most probably a fictitious species, and the *Tailor Bird* described and figured by Forbes in his Oriental Memoirs, appears to be a *Cinnyris* (*C. purparata*), which builds a somewhat similarly constructed nest.

The *Tailor Bird* is tolerably common in most wooded districts, and universally spread, frequenting cultivated ground, especially gardens, groves of trees, and also found in high jungle, in the more open spaces. It lives in pairs or in small flocks, incessantly hopping about the branches of trees and shrubs, peas and other vegetables, with a loud reiterated note, and picking various insects (chiefly ants and small larvæ) off the bark and leaves, and not unfrequently seeking them on the ground. It has the habit of frequently jerking up its tail while feeding or hopping about, and at times (especially when calling) it has the power of raising the feathers on the lower part of its throat, and displaying on either side a small black stripe. This has been noted by no one except Lieut. Hutton. The *Phootkee* has various notes, one of which sounds like *twee*, *twee*, *twee*, as mentioned by Colonel Sykes, and another which is generally used when alarmed or angry, and sounds like *chick, chick, chick chicky, chick.* It is a familiar bird, and ventures close to houses, but when observed becomes wary.

The *Tailor Bird's* nest truly merits all the praise and wonder that have been bestowed on it. I have seen several, and can bear testimony to the accuracy of Colonel Sykes' and Lieut. Hutton's accounts of it, as also to the accuracy of the coloured drawing of one which accompanied, a representation of this species in Guerin's 'Magasin de Zoologie.' Colonel S. has, however, on some occasion probably mistaken the nest of some other bird for it, as he says in his account of the nest and eggs,* that the latter are crimson, whereas in two instances, in which they were observed by me, they were white, spotted chiefly at the larger end with reddish brown, as described by Lieut. Hutton.

Length about 6 inches (to tip of longest tail feather); of wing about 2; tail $1\frac{8}{10}$ths; centre feather of ditto 1 inch more; tarsus $\frac{8}{10}$ths. Irides orange buff; bill brown above, flesh coloured below; legs flesh coloured.

115.—*O. Lingoo*, Sykes.

I have not hitherto procured this bird of which Colonel Sykes says

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* Proceedings of Zoological Society for 1834.

"differs from the type of *Orthotomus* in its short tail. Principal food black ants. Length $5\frac{6}{10}$ths; tail $2\frac{1}{10}$th."

GEN. PRINIA, Horsf.—*Pit-pittee*, H.—*Wren Warbler.*

This genus, or sub-genus perhaps, though not admitted by Swainson, I am inclined to adopt in consequence of the well defined group of Indian birds classed under it, which do not exactly correspond with any of Swainson's, though they nearly approach to *Drymoica* (a sub-genus of *Malurus*), and probably connect it to *Orthotomus*, with which they are also strongly allied. All the species I have noticed, have similar manners and habits. In this respect they somewhat approach the *Thimaliæ* or *Babblers*, which they perhaps represent in this family, as well in their long, indistinctly barred tail, long legs, short wings, and other structural points, as in their occasionally associating in small flocks, and their incessant calling.

116.—*P. socialis*, Sykes.—*Ash-coloured Wren Warbler.*

This species of *Prinia* is unequally distributed over the peninsula, being tolerably common in some localities, and rarely met with in others. In the Carnatic, I have met it among reeds and long grass, by the side of rivers and tanks; on the west coast in similar situations, and much more common; while I have hitherto seen it but rarely in the table land. On the Neilgherries near Coonoor and Kotāgherry, it is very abundant in dry bushy ground.

Colonel Sykes says of this species "has the same ingenious nest, and has the same habits and note, and feeds in the same manner as *O. Bennettii*." I have not verified this observation as to the nidification of this bird, and have found the nest of another species to be very different. Irides orange buff; bill black; legs flesh coloured yellow. Length $5\frac{2}{10}$ths; wing rather more than 2; tail $2\frac{3}{10}$ths; tarsus $\frac{6}{10}$ths.

117.—*P. gracilis*, Franklin.—*Small Wren Warbler.*

This species much resembles the last in colour, but is much smaller, white below, instead of fawn colour, and I have only hitherto found it in wooded places and jungly districts (frequenting trees as well as bushes) in the west coast, and northern part of the table land.

118—*P. inornata*, Sykes.—*Common Wren Warbler.*

This is a very common bird in all parts of the peninsula, frequenting low bushes on the open plains, hedges, low trees, grain-fields, &c. It is found generally in pairs, or sometimes in small flocks, feeds on ants, larvæ and various insects, and endeavours to conceal itself in the thick bushes or hedges, and on being driven away flies off to the nearest bush or tree with the low jerking flight common to others of the genus. I once procured the nest of this species, it was open at the top, neatly enough made with grass, well interwoven, without any lining, and fixed in a low bush, very near the ground: it contained four blue eggs. Irides, brownish yellow; bill, brown above, yellowish below. Length about 5 inches; wing $1\frac{2}{10}$ths; tail $2\frac{3}{10}$ths; tarsus about $\frac{2}{10}$ths.

119.—*P. Macroura*, Frankl. Cat.—*Long tailed Wren Warbler.*

This is a very closely allied species to the last, though perfectly distinct, differing in the more reddish or fawn tint of the brown, and the more rufous tint of the white. It is much more rare than the last, and prefers more jungly and wooded places. Length of one specimen 6 inches; of tail, rather more than 3; wing hardly $1\frac{8}{10}$ths; tarsus $\frac{8}{10}$ths. Irides, brownish orange; bill brown, pale yellow at the base of the lower mandible.

120.—*P. sylvatica.*—New species?—*Jungle Wren Warbler.*

Descr.—Above olive brown; below and superciliary mark white, tinged with yellowish; tail obsoletely barred, with a larger bar at the tip, and terminated by white, except in the centre feathers; bill strong, black; legs flesh coloured. Irides orange buff. Length 6 inches; wing $2\frac{4}{10}$ths; tail $2\frac{7}{10}$ths; tarsus nearly one inch.

I have only seen this species hitherto in open forest jungle in the Segoor pass of the Neilgherries.

121.—*P. rufifrons.*—New species?—*Red-fronted Wren Warbler.*

Descr.—Forehead and head rufous; above greenish ash coloured; beneath white; tail brown, and except in the centre feathers, broadly terminated by white, especially the outer feathers. Bill brown, pale below; legs flesh coloured. Irides pale orange buff. Length 5 inches; wing rather more than $2\frac{1}{10}$th; tail $2\frac{4}{10}$ths; tarsus $\frac{8}{10}$ths. I have only seen this apparently new species in low thick jungle in the neighbourhood of Jaulnah. It associates in small flocks; is very wary, flying before you from bush to bush, with a low chirping note, and so much the manners of a *Thimalia*, that I at first mistook it for one.

122.—*P. cursitans*, Frankl. Cat.—*Ghas ka Phootkee*, or *Ghas ka Pitpittee*—*Grass warbler*—*Meadow Wren Warbler.*

This curious lark-plumaged little species of *Prinia* frequents long grass, whether on sides of nullahs, or in the open plains, and is far from being uncommon in most of the large rumnahs of the table land. I have also seen it in the west coast. When disturbed it takes a short interrupted flight, and on seating itself hides among the tufts of grass, and often runs several yards. It feeds on ants, the larvæ of small grasshoppers, and various other insects. This bird if not an aberrant species of Swainson's genus *Praticola*, is probably a link joining it to the *Priniæ*. It differs from the character of *Praticola* in its shorter hind claw, and unnotched bill. Irides brownish yellow; bill brownish above, pale below; legs flesh coloured. Length 4 to 4$\frac{1}{4}$ inches; of wing 2; tail nearly 2; tarsus nearly $\frac{8}{10}$ths. I have specimens smaller than this in every respect, killed below the ghauts.

SUB GENUS SYLVIA.—*True Warbler.*

123.—*S. Montana*, Horsf.

This species (if truly distinct), which differs from the next only in size, is rare in the peninsula. I possess but one specimen, the locality of which I have mislaid. Length 5$\frac{9}{10}$ths; wing 2$\frac{4}{10}$ths; tail rather more than 2; tarsus, $\frac{8}{10}$ths; first quill feather very minute and sharp pointed, 2d quill feather longer than the 6th.

124.—*S. Rama*, Sykes.—*Village Warbler.*

This is a tolerably abundant bird in most parts of India, frequenting hedges, gardens and trees, in cultivated ground, and near villages. It is lively and active, hopping about the branches, and capturing various small insects, occasionally on the wing, but generally on the branches or leaves. It has a rather harsh chuckling note which it incessantly utters on being approached, and endeavours to hide itself, creeping to the farther side of the tree. Some time ago a nest, carelessly put together with twigs and grass, containing 4 pure white eggs, was brought to me as the nest of this species. It was found in a hedge. Irides yellowish brown; bill brown above, yellowish below; feet flesh coloured yellow. Length 4$\frac{8}{10}$ths; tail about 2 inches; wing to end of 3d quill 2$\frac{4}{10}$ths; Ist a spurious quill feather larger and more rounded than *in the last*, and the 2d is only equal to the 7th.

125.—*S. Trochilus* ?—*Willow Warbler* of Europe.

I possess a single specimen, of what I suppose is this bird, obtained lately in a wooded valley, along the edge of the northern range of ghauts. It appeared active and lively in its habits, occasionally flying from some reeds, and perching on a stone in a brook, and from thence making short sallies after insects in the air, or seizing one on the sand of the rivulet. I shall here add a brief description of my specimen. Above brownish olive; beneath whitish, tinged with yellow on the underwing, and tail coverts also on the outer edge of the wing. Length not quite 5 inches; of wing 2½; bill and legs brownish black.

126.—*S. hippolais* ?—*Chif-chaff* of Europe.

I possess specimens of what I shall consider as this bird, till they have been examined and identified in Europe. I procured them in the elevated district of Wynaad, and on the Neilgherries. Two of the specimens have their plumage consisting entirely of green and yellow, but these, I see, are considered by Yarrell as young birds. They were seen hopping briskly about the branches of high trees. Irides light brown. Length 4$\frac{6}{10}$ths; wing 2$\frac{3}{10}$ths; tail 1$\frac{8}{10}$ths; bill much wider than in the last species.

127.—*S. Indica.*—New species ?

This warbler somewhat approaches the description of *S. Javanica* of Horsfield, but differs in wanting the fulvous hue of the forehead and chin. I have hitherto seen it but rarely, and only in the more northern parts of the table land, during the cold weather. I saw it frequenting trees, hopping briskly about the smaller twigs; also on one occasion on a bush on the side of a precipitous rocky mountain.

Descr.—Above olive grey; beneath olivaceous yellow; eye-streak bright yellow; bill brown above, yellowish below; legs greenish brown. Length 5 inches; of wing $2\frac{4}{10}$ths; tail about 2; tarsus $\frac{8}{10}$ths.

SUB FAMILY PARIANÆ.—*Tits.*

SUB GENUS ZOSTEROPS, Horsf. and Vig.—*White-eye.*

128.—*Z. Maderaspatensis.*—*Mot. Maderaspatana*, L.—*S. leucops*, Vieill. Encycl. Meth. p. 441.—*S. palpebrosa*, Temm. P. C.—*Indian White-eye.*

This pretty plumaged little bird I have hitherto found in greatest abundance on the summit of the Neilgherries. Towards the more northern portion of the table land, it begins to occur, though sparingly, in the more wooded parts; and it is of tolerably frequent occurrence among the more wooded valleys of the northern ghauts. On the Neilgherries it frequents both the thick woods and gardens, and in the latter may often be seen clinging to the flower stalks, extracting the minute insects that infest flowers, by the pollen of which its forehead is often powdered. It feeds generally in small flocks, is lively and brisk in its movements, and keeps up a continual feeble twitter. Irides light yellowish brown; bill blackish; legs horn coloured. Length about 4½ inches; wing $2\frac{3}{10}$ths; tail $1\frac{7}{10}$ths.

SUB GENUS PARUS.—*Tit.*

129.—*P. atriceps*, Horsf.—*Black-headed Tit.*

I have only seen this Indian *Tit* towards the south of the peninsula on the Neilgherries, where it is common in the woods, associating in small families, and feeding on various insects and seeds, to obtain which it occasionally resorts to the gardens. I have seen it once or twice only along the range of northern ghauts, but it probably is to be found all along the range of western ghauts, as it is enumerated in the catalogues both of Colonel Sykes and Mr. Elliot.

130.—*P. Xanthogenys.*—*Yellow cheeked Tit.*

This species is also an inhabitant of the Neilgherries, but I only observed it in the warmer parts about the edges of the hills. I have hitherto observed it in no other locality, but it is mentioned in Mr Elliot's catalogue, as well in Colonel Sykes'. Food and habits of the last. Irides light brown.

131.—*P. melanolophus*, Vigors.—Gould's Cent.

I have only observed this pretty little species in Goomsoor, where I found it frequenting lofty trees in open spaces in the jungle.

132.—*P.* ? *minutus*.—New species?

I lately obtained in a wooded valley at the edge of the northern ghauts a single specimen of a small species of *Tit*, but unfortunately in imperfect plumage. It has the upper surface of the body of a greenish ash colour, tinged on the forehead, rump, and upper tail coverts with greenish yellow; beneath cincreous white, tinged in spots with light yellow; wing coverts edged with greenish yellow; bill and legs lead colour. Irides light brown. Total length about 3$\frac{8}{10}$ths of an inch; of wing 2 $\frac{4}{10}$ths; tail 1¼; tarsus $\frac{5}{10}$ths. Its bill is larger, and less robust than in the *Tits*, in general approaching that of *Ægithalus*.

SUB GENUS PARISOMA, Sw. ?—Vieill.—Sect. 1. Swains.?

133.—*P.* ? *vireoides*.—New species. ?—*Olive Tit.*

This curious little bird appears to be a link joining the *Parianæ* to the *Vireoinæ*. It has the bill considerably more strongly developed than in *Parisoma*, as described and figured by Swainson, but as it otherwise appears to agree with it, may be considered as an aberrant species. I first obtained this *Tit* in open spaces in the jungle in Goomsoor, and have lately observed it in lofty trees towards the more northern portion of the table land. It associates in small flocks, and frequents the highest branches, hopping briskly about, and diligently examining the leaves, fruit and flowers for various insects. I found its food to consist of small spiders, insects, eggs and larvæ, aphides and various other minute insects.

Descr.—Above, greenish olive; wings and tail brownish; the feathers of the former edged with light olive, and those of the tail tipped with white; beneath, dirty greenish white; bill and legs lead colour. Irides orange yellow. Total length 4 inches; wing 2 $\frac{2}{10}$ths; tail 1$\frac{8}{10}$ths; tarsus $\frac{5}{10}$ths.

SUB FAMILY MOTACILLINÆ.—*Wagtails.*

GEN. BUDYTES, CUV.

134.—*B. citreola.*—*Yellow headed Wagtail.*

This species is occasionally met with in most parts of India, during the cold season, but is not nearly so abundant as the next species. I have seen it on the banks of rivers, and also in wet paddy-fields.

135.—*B. neglecta*, Gould.—*B. Beema*, Sykes.—*B. flava*, of Continental authors.—*Peelkya*, H.—*Yellow Wagtail.*

The *B. Beema* of Sykes, appears to be identical with the species from the continent of Europe, lately pointed out by Gould, as differing from the *B. flava* of Britain.

The *Peelkya* is an extremely common bird in all parts of India, during the cold weather, remaining till April. It associates together occasionally in large flocks, frequenting damp spots of ground near tanks, and marshy places, but also the grain-fields, and dry plains, feeding among cattle. Single birds, however, or two or three together, are not uncommonly seen about houses, and in gardens, sometimes perching on trees, or the top of a house, or wall. It feeds on various minute insects and their larvæ.

136.—*B. melanocephala*, Sykes.—*Black headed Wagtail.*

I am very doubtful if this is a distinct species from the last. It is generally found in company with it, and I have seen many specimens during the moulting, when there were only a few feathers on the head, that had assumed the black. I have a specimen with the head of a lead colour, and a stripe from the angle of the mouth to the ears only black, without any superciliary stripe. This is probably the female, whether it be a distinct species, or only the winter plumage of the last. Habits and food, same as the last.

136.—bis.—*B. flava*, Ray, Gould.—*Yellow Wagtail* of British authors.

If the yellow superciliary mark be an unerring characteristic of this British bird, it may also be enumerated as a winter visitant to India. I have shot it in company with *B. neglecta*, and the last.

Gen. MOTACILLA, Auct.—*True Wagtail.*

137.—*M. boarula.*—*Wood* or *Jungle Wagtail.*

This species is numerous on the Neilgherries, where it frequents running streams, also enters gardens, &c. It is very abundant on the passes leading up to the hills, hopping along the road, and flying before a traveller, often for some distance. I have once or twice seen it lately in woody streams in the more northern portion of the table land, during the cold weather only.

138.—*M. Maderaspatensis*, Auct.—*M. picata*, Frankl.—*M. variegata*, Steph.—*Mhamoola*, H.—*Indian Black* and *White Wagtail.*

This species is found throughout the peninsula, only in beds of rivers. Length nearly 9 inches; tail 4; wing 3$\frac{8}{10}$ths.

139.—*M. variegata*, Vieill.—Encycl. Method. p. 408.

I have not myself met with this species, which Mr. Elliot's notes have made known to me as an Indian bird, and from which I take the following description, " Above brown cinereous; beneath white; wings medial; tail feathers (not the centre ones), and two chest-bands, black; eye-brows, two diagonal bars on the coverts, and an imperfect third one on the quills, and ends of two outer rectrices, white; two brownish lines down the throat. Length 6½ inches." I see this is also enumerated by M. Lesson, as an inhabitant of Bengal.

140.—*M. alba*, Auct.—*Mot. Dukhunensis*, Sykes.—*Dhobeen*, H.

I have not hitherto observed this species in the Carnatic, but it is very common over most of the table land, during the cold weather only, migrating to the north, at the commencement of the hot season. It frequents rivers, open fields, gardens, villages, stable yards, &c., and occasionally even enters houses, feeding on a great variety of insects.

GENUS ANTHUS.

I shall under this genus, enumerate two species, which although they do not exactly come under Swainson's restricted definition, are yet considered as *Anthi*, by most authors, and they have more of the manners of this family than of the *Larks*, with which Swainson has very properly, I think, associated most of the species, of the *Anthus*, of older authors.

141.—*A. arboreus ?—Tree Pipit ?.—Musarichee*, H.

This species, so much resembles the description of the *Tree Pipit* of Europe, that in the absence of more precise information, I shall consider it as such. It is only a visitor, during the cold weather, coming in October, and remaining till April or May. Associates generally in small flocks, frequenting beds of wooded streams, edges of tanks, and other moist places. Is also found in grain-fields, gardens, and groves of trees. It feeds partly on the ground, on various insects, and also on grain, and on being disturbed flies up to the nearest tree. It frequently, however, feeds on trees, hopping about the upper branches, like a *Sylvia*, and occasionally even snapping at an insect on the wing. Mr. Elliot says, " Its flesh is used by falconers as a restorative to the *Bhyree*, and is said to be very delicate." Length 6½ inches; wing 3½.

142.—*A. Richardi ?*

It is with some hesitation, that I consider the specimen, which I possess, to be the same as the *Anthus Richardi*, but as it appears to agree with many of the characters, as given in the descriptive works I possess, I shall do so provisionally, till correct information be obtained. I have only met with this bird, on one occasion, on the banks of the Tumbuddra. It was in pairs, and its manner of flight was exactly similar to that of the *Wagtails*.

Descr.—Above olive brown, shaded with dusky, and many of the feathers edged with whitish; beneath whitish, the breast streaked with brownish, and a brown streak running down from the base of lower mandible on either side. Irides brown. Length 7½ inches; wing $3\frac{7}{10}$ths; tail about 3; tarsus $1\frac{3}{10}$ths; hind toe $1\frac{1}{10}$ths (with claw); claw alone $\frac{6}{10}$ths.

Fam. MUSCICAPIDÆ, Swains. ?

Sub Fam. MUSCICAPINÆ, Sw.—*True Flycatchers.*

Genus RHIPIDURA, Vig. and Horsf.

Sub Genus LEUCOCIRCA, Swains.—*Fantailed Flycatcher.*

143.—*L. albo-frontala.*—*R. albo-frontala,* Frankl.—*White browed Fantail.*—*Mucchureea* (i. e. *Mosquito catcher*), H.—*Manatee,* Mal.

This pretty and lively *Flycatcher,* is only to be met with in the southern parts of the peninsula, in well wooded districts, and open forest jungle, as in Travancore and Malabar. I have never seen it in the Carnatic. Towards the northern part of the table land, however, it is much more common, being met with during the cold weather in every clump of trees, and in wooded nullahs, indeed, throughout the year. It is a most active and restless little creature, continually flitting about, from branch to branch, snapping up an insect on the wing, every now and then, and raising its outspread tail, and lowering its wings, whenever it reseats itself on a twig. It is by far the most restless of all the Indian *Flycatchers,* seldom returning to the same perch, but traversing successively all the branches of the large trees it delights to frequent. It is by no means uncommon in gardens, seating itself on the sticks of peas or beans. I have once or twice seen it perched on the back of a cow, that was laying down beneath a tree, and pursuing insects from this unusual perch. I have also seen it on the ground, near a thick hedge side. It has a very sweet little song, which it warbles forth every now and then, consisting of several notes following each other regularly in the descending scale. Its chief food is small soft-winged insects, especially musquitoes. Its Malyalam name signifies '*washerwoman,*' and is given from the continual motion of its tail. Irides dark brown; bill and legs black. Length about 7 inches; tail 3 $\frac{7}{16}$ths; wing 3 $\frac{2}{16}$ths; tarsus $\frac{7}{16}$ths.

144.—*L. fuscoventris.*—*R. fuscoventris,* Frankl.

I have not hitherto shot this species, and have only once observed it in low bushy ground on the Neilgherries. Colonel Sykes mentions it as frequenting the same localities as the last species.

GENUS MUSCICAPA, Auct.

SUB GENUS CRYPTOLOPHA, Sw.

145.—*C. poiöicephala*, Swains. Nat. Libr. vol. 21, Pl. 23.—*Grey-headed Flycatcher.*

The only locality in the more southern part of India, where I have met this curious little bird, is the summit of the Neilgherries, in the dense woods of which it is not very uncommon. In the northern part of the Deccan, however, it is occasionally to be met with, only in the cold season however, in large topes of trees, and it increases in number towards the north, and in the jungly valleys and nullahs of the northern ghauts, it is by no means rare, always frequenting by preference the deepest thickets. Though not so lively as the *Fantails*, it is yet more so than many of the *Flycatchers;* it frequently sallies forth from its perch on a twig after passing insects, and does not always return to the same branch, and often changes its perch, though it remains for some time in the same locality. It has a pleasant but feeble chirping note. Irides deep brown; bill brown above, pale beneath; legs reddish. Length rather better than 4½ inches; wing 2 $\frac{3}{10}$ths; tail 2 $\frac{2}{10}$ths; tarsus ½ inch.

SUB GENUS MUSCIPETA, Cuv., Swains.

146.—*M. Paradisi*, Auct.—Sykes' Cat.—*Houssenee Bulbul*, H.—*Long tailed white Flycatcher.*

This most lively and elegant bird, is far from being common in any part of the peninsula, but is to be found in greatest plenty in the extensive woods of the western coast. Occasionally it is met with in the Carnatic, in the more wooded parts, and even in gardens, as also, though more rarely, on the table land. It feeds chiefly on insects caught on the wing, now and then snapping a caterpillar or other insect off a branch.

I never saw it feed on the ground, as mentioned by Colonel Sykes, nor have I usually found its food to consist of very minute insects, having on several occasions seen this as well as the next species, feasting on good sized caterpillars, but my opportunities of observing it have hitherto been few. This, as well as the *Sultana Bulbul*, are certainly less sedentary in their habits, than the true *Muscicapæ*, and have the habit of wandering more from tree to tree, and less frequently returning to the same perch. This, in accordance with Le Vaillant's observations, as mentioned by Swainson. The flight of this species is very elegant. I always observed it single. I have not had the means hitherto of verifying Colonel Sykes' remarks on the females of this, and the next species. The female of this as described by Colonel Sykes, appears to be identical with the supposed new species of Swainson, figured in his volume on *Flycatchers*, in the Naturalists' Library, under the name of *M. leucogaster*. Length about 10 inches; of wing $3\frac{8}{10}$th; tail 5 to 6 inches; tarsus $\frac{7}{10}$ths; bill to front $\frac{7}{10}$ths; at gape $1\frac{1}{10}$th; bill and naked skin round eye of a delicate lilac blue colour; feet plumbeous. Irides deep brown.

147.—*M. Indica*, Steph.—*M. castanea*, Temm.—*Shah Bulbul*, or *Sultana Bulbul*, H.—*Long-tailed red Flycatcher.*

The *Sultana Bulbul* is more common, and more generally spread than the last, though far from being abundant. Food, manners and habits of the last. Dimensions, &c. as in *M. Paradisi.*

SUB GENUS MUSCICAPA, SW.

148.—*M. cærulea*, Veiell. Encyl. p. 807.—*M. occipitalis*, Vig. Proc. Z. S. for 1831.—*Black-naped Blue Flycatcher.*—*M. cæruleocephala*, Sykes' Cat. Young bird ?—*Gobe-mouche bleu des Philippines*, Buffon. *Pl. En.* No. 666, fig. 1.

The *M. occipitalis* of Vigors, appears to be identical with the bird previously named as above. It is very rare in the peninsula. I have only seen it twice, once on the Coonoor pass of the Neilgherries, and again in the Wynaad, in both places in dense jungle. I have also seen a specimen shot in the Malabar Coast. At the times I observed, it was flying from tree to tree, remaining on each a short time, and capturing an insect or two, and then resuming its flight. The form of this *Flycatcher* is peculiarly slender and delicate, differing much from the more rounded and compact forms of the true *Muscicapæ*. Irides deep brown; bill bluish; legs bluish black. Length 6 inches; of wing to end of 5th quill $2\frac{8}{10}$ths; of tail $2\frac{3}{4}$; tarsus $\frac{7}{10}$ths; bill to front $\frac{4}{10}$ths; to gape $\frac{6}{10}$ths. This is evidently an aberrant species, leading to *Myia-*

gra by its long tail (which is slightly rounded), and other peculiarities of form.

149.—***M. pallipes.***—New species ?—***M. Indigo,*** Horsf. ?—***White bellied blue Flycatcher.***

This species resembles much the description of *M. Indigo* of Horsfield, but that is said to be only 4½ inches long (Griff. Cuvier), and is therefore perhaps distinct. I have only shot a single specimen of this species, in thick forest on the Coonoor ghaut, where I observed it darting on insects from its perch on a low branch.

Descr.—Entirely of a deep indigo blue, except belly and under tail coverts, which are white; wings and tail dusky on their inner webs; bill, black; legs, feet, and claws pale whitish flesh-colour. Irides deep brown. Length about 6½ inches; of wing $3\frac{1}{10}$ths; tail 2½; tarsus more than $\frac{7}{10}$ths; bill to front about $\frac{5}{10}$ths; to gape $\frac{8}{10}$ths; the 5th and 6th quills are subequal and longest, and the tail is nearly even.

150.—***M. Banyumas,*** Horsf.—***Red breasted blue Flycatcher.***

This pretty little species, is spread, though sparingly, throughout India, and I have met it wherever there was much wood, in Goomsoor, in the Northern Circars, at the Tapoor pass, in the Carnatic, and on the west coast, where it is of tolerably frequent occurrence. I have also seen it in the northern part of the bare table land, once in a clump of trees near a village, and again in a jungly nullah. It feeds in general, like its congeners, from a fixed perch, catching its prey on the wing, but I have repeatedly seen it descend to the ground to pick up an insect. and even hop a step or two whilst down.

The structure of its bill is similar to that of the last, viz. long and tapering, and the 4th and 5th quills are subequal and longest; bill black; legs brownish. Irides deep brown. Length rather more than 5½ inches; wing $2\frac{9}{10}$ths; tail $2\frac{3}{10}$ths; tarsus $\frac{7}{10}$ths; bill to front $\frac{4}{10}$ths; to gape $\frac{7}{10}$ths.

151.—***M. melanops,*** Vig.—Gould's Cent.—***Pale blue Flycatcher.***

I possess two specimens, of what I consider to be this species, as well from the drawing in Gould's Century, as from the description. The one I procured in Goomsoor, the other in a jungly valley at the edge of the northern ghauts near Ajunteh. It captures its insect prey on the wing, as well as occasionally on the ground, returning to the same perch. Length about 6 inches; of wing 3 $\frac{3}{10}$ths; tail 3 inches; tarsus $\frac{6}{10}$ths; bill to front $\frac{3}{10}$ths; to gape $\frac{6}{10}$ths; bill and legs black. Irides deep brown; bill short triangular—4th quill the longest, 3d subequal to the 5th.

152.—*M. albi-caudata.*—New species?—*M. thalassina*, Swains.?—*White tailed* or *Neilgherry Blue Flycatcher.*

Descr.—Of a deep indigo blue colour, inclining to lazuline on the forehead, head and shoulders; belly ashy blue mingled with whitish; under tail covert whitish, barred with dusky blue; wings and tail dusky black; the feathers edged with blue, and those of the tail (the centre feathers excepted) white at their base; bill and legs black. Irides deep brown. Length 6½ inches; of wing 3 $\frac{2}{10}$ths; tail 2 $\frac{6}{10}$ths; tarsus $\frac{7}{10}$ths; bill to front $\frac{4}{10}$ths; to gape $\frac{7}{10}$ths; bill rather longer and less triangular than in *M. melanops*, not so long as in *M. pallipes* and *M. banyumas*—4th and 5th quills equal and longest.

I have hitherto only found this species on the Neilgherries, in the dense woods of which it is far from being uncommon. It captures insects of various kinds on the wing, from a fixed perch, occasionally a small flock of five or six of them are seen together in a state of continual movement, taking short darts and gambols in the air, as much in sport apparently, as in actual pursuit of insects.

153.—*M. superciliaris.*—New species?.—*White browed blue Flycatcher.*

Descr.—Above and sides of the breast, of a beautiful light indigo, or rather prussian blue, beneath; superciliary stripe extending to some distance behind the eyes, and base of the tail; feathers (except the central ones), pure snowy white. Some of the feathers of the rump with the shaft, and a bar in the middle of the feather, also white; bill and legs black. Irides deep brown. Length 4¾ inches; wing 2 $\frac{5}{10}$ths; tail 1 $\frac{8}{10}$ths; tarsus $\frac{6}{10}$ths; bill to front $\frac{3}{10}$ths; to gape $\frac{6}{10}$ths; bill more lengthened than in the two last, very little compressed; wings with 4th quill longest, 3d and 5th subequal.

I lately obtained a single specimen of this beautiful little species, in a wooded valley, at the edge of the range of northern ghauts.

154.—*M. Poonensis*, Sykes.—*M. latirostris*, Swains. Nat. Lib. vol. 21?—*Zukkee*, H.—*Indian Grey Flycatcher.*

I possess two specimens, which, as they differ only in size, I consider as identical with the species named as above by Colonel Sykes, and Swainson's supposed new species does not appear to differ from them. The smaller of my specimens was procured in the hot Carnatic, near Trichinopoly, the larger one on the Coonoor pass of the Neilgherries, at a considerable height. I have observed it on several other occasions, both in the Carnatic, and on the Malabar Coast. It feeds on insects, which it captures on the wing from a fixed perch, and it is, I think, more sedentary in its habits than any of the previously described *Flycatchers*. Bill blackish above, whitish below, except at tip; irides deep brown; legs brown. Length of my specimens 5 and $5\frac{3}{4}$ inches; of the first, the wing is $2\frac{7}{10}$ths; tail 2; tarsus $\frac{5}{10}$ths; bill to front $\frac{4}{10}$ths; to gape nearly $\frac{7}{10}$ths. In the larger one the wing is 2[illegible]ths. In both the 3d and 4th quills are equal and longest.

155.—*M. hirundinacea*, Horsf., Temm.—*M. picata*, Sykes.—*Tephrodornis hirundinaceus*, Sw.?—*Black and white Flycatcher.*

This bird has so much the habits, as well the general structure and appearance of a *Flycatcher*, that I shall for the present here retain it, and a closely allied species, although Mr. Swainson has, I see, ranged it as a *Tephrodornis.*—Vide remarks *postea.*

I have only hitherto seen it on the Neilgherries, where it is not very uncommon in the woods, darting upon insects in the air from a branch, and though perhaps it wanders about more than many of the genus, is yet not nearly so restless as the *Fantails*. Bill and legs black; irides sienna yellow. Length $5\frac{1}{2}$ to 6 inches; of wing $2\frac{9}{10}$ths; of tail $2\frac{4}{10}$ths; tarsus nearly $\frac{1}{2}$ inch; bill to front $\frac{4}{10}$ths; at gape $\frac{7}{10}$ths.

156.—*M. erythropygia.*—New species?—*Tephrodornis?*—*Red breasted Flycatcher.*

Descr.—Male:—plumage above, cheeks and chin, of a glossy blue black; beneath, longitudinal stripe on the wings, and outer edges and tips of the lateral tail feathers, white; breast and rump of a beautiful orange red, darkest on the rump.

Female,—with the parts black in the male, of an ashy brown (except the tail which is deep black); feathers at the base of the bill above whitish; rump, outer edges and tips of the lateral tail feathers, and beneath, white, tinged with ashy on the breast. Bill and legs black;

irides brownish yellow. Length 6½ inches; of wing $2\frac{7}{10}$ths; tail $3\frac{3}{10}$ths; tarsus ½ inch; bill to front $\frac{3}{10}$ths; at gape $\frac{6\frac{1}{2}}{10}$ths.

I have only once seen this prettily marked species, in low and thick jungle on the top of the ghauts, near Ajunteh, when I fortunately procured both male and female. I found fragments of various insects in their stomachs, but had no opportunity of observing their manner of feeding or other habits.

These two last species certainly differ from *Muscicapa* in some particulars. Their tarsi are distinctly scaled, and the bill (especially of the former species), is stronger, more *shrike*-like, and less depressed; but their small size, the habits as observed of the first species, and general appearance, led me in the first instance to overlook these differences, and I had not observed that Swainson had described the first as a *Tephrodornis*, when I was enumerating the species of that genus.

TRIBE CONIROSTRES.

FAMILY CORVIDÆ.

SUB FAMILY CORVINÆ.

GENUS CORVUS.—*Crow.*

157.—*C. splendens*, Vieill.—*Patee Kowa*, H.—*Common Crow.*

This is the common crow of India, and is most abundant every where, roosting on high trees, and spreading in the morning through villages, and cantonments, &c. It is a most familiar, noisy and impudent bird. It breeds on trees in the hot weather.

158.—*C. macrorhynchos*, Wagl.—*C. culminatus*, Sykes.—*C. corone*, var., Frankl. Cat.—*Dheree Kowa* or *Kurrial*, H.—*Large black crow.*—*Indian Carrion Crow.*

This species, though not so numerous as the last, is yet very abundant, and nearly equally troublesome and impudent. It partakes more readily than the last of carrion, and I think the *King Crows* appear to pursue it with greater hatred than the common crow, so it probably occasionally pilfers their eggs or young. Irides dark brown; bill and legs black. Length 21 inches; of wing $13\frac{4}{10}$ths; tail $7\frac{3}{4}$; tarsus $2\frac{1}{2}$; bill to front $2\frac{4}{10}$ths; at gape $2\frac{1}{2}$.

SUB FAMILY GLAUCOPINÆ, Swains.

GENUS CRYPSIRINA, Vieill.—DENDROCITTA, Gould.—*Tree Crow,* or *Magpie.*

As Swainson asserts the identity of these two genera, I take the former as being the legal generic name.

159.—*C. vagabunda.*—*Pica vagabunda,* Gould's Cent. pl. 42.—Gray and Hardw. Ill. I. Z.—*Coracias vagabundus,* Lath.—*Maha Lat,* H. of some *Shikarees.*—*Indian Magpie.*

This bird, the *Indian Magpie,* is generally spread throughout the South of India, but is only at all plentiful on the well wooded western coast, where it is to be seen and heard in every lofty avenue. In the Carnatic, I have only seen it in the jungly district near Touremcourchy, and in the table land it is also rare, being met with only occasionally in jungly districts, or in the neighbourhood of well wooded villages. It frequents the highest jungles occasionally, not in their densest portions, however. This bird is found single or in pairs, occasionally four or five being seen together. It lives, as far as I have ascertained, entirely on fruit of different kinds, and is very fond of the fruit of the banian. It has a most peculiar cry, something like the metallic sound of the call of the *Racket-tailed Drongo (Dicrurus retifer)*, but its usual call is a harsh rattling cry, like that of the European *Magpie.* Irides blood red; bill black; legs slate colour. It is considered by the natives as a kind of *Shrike.* Length about 16 inches; wing 6; tail 10; tarsus $1\frac{2}{10}$ths; bill straight to gape $1\frac{2}{10}$ths.

160.—*C. lencogastra.*—*Dendrocitta lencogastra,* Gould, Trans. Zool. Soc. vol. 1, pl. 12.—*Long tailed Magpie.*

This very elegant species is much more rare than the last. I have only seen it in the jungles of Malabar and the Wynaad. It frequents the densest portions of the jungles, and is extremely shy and wary, feeding like the last on various fruit and berries. It has a somewhat similar call. Irides blood red; bill black; feet plumbeous. Length $18\frac{1}{2}$ to 19 inches; wing $5\frac{3}{4}$; tail 12; tarsus $1\frac{3}{10}$ths; bill straight to gape $1\frac{2}{10}$ths.

161.—*C. Sinensis.*—*Pica sinensis,* Gould's Cent. Him. Birds, pl. 43.

I have hitherto not been fortunate enough to procure this bird, though I think I have observed it in open jungle on the Segoor pass of the Neilgherries; but I have seen specimens, killed in the eastern range of ghauts.

FAMILY STURNIDÆ.—*Starlings.*

SUB FAMILY STURNINÆ, Swains.

GENUS STURNUS, Lin.

162.—*S. contra,* Gmel.—*S. capensis,* Lath.—*Pastor Contra,* Wagl.—Buffon P. E. 280.—*Indian Starling.*

The *Indian Starling* occurs in great abundance in the district of the Northern Circars, but, as far as I can learn, in no other part of the peninsula of India. I first met it a few miles to the north of Vizagapatam, and saw it afterwards throughout the whole district to the northward, as far as the Goomsoor country, where it is very numerous. It lives in large flocks, feeding on the ground and associates freely with the common *Myna.*

I know not if it remains here during the whole season. I saw it in the cold weather. Length $8\frac{1}{2}$ inches; wing 4 $\frac{6}{10}$ths; tail $2\frac{3}{4}$; tarsus $1\frac{3}{10}$ths; bill to front $\frac{9}{10}$ths; straight to gape $1\frac{7}{10}$ths.

GENUS PASTOR.—*Myna,* H.

163.—*P. tristis,* Temm.—*Gracula tristis,* Lath.—*Grac. gryllivora Dand,* Buffon P. E. 219.—*Myna,* H.—*Saloonkee,* Mah.—*Gorwuntra Can.*—*Common Myna.*

This well known and common bird is found throughout India, preferring the neighbourhood of cultivation and villages, and never found in high or dense jungle. It roosts in numerous flocks, generally on high trees, and disperses in various parties of two, four, six, or more, about sun-rise. Some enter the villages and cantonments, others attend flocks of sheep or cattle, which they follow while grazing, feeding on the grasshoppers and other insects, disturbed by the treading of the cattle. The *Myna* also will feed on grain, and seeds of various kinds, and is very fond of white ants. Its flight is swift, steady and direct. It breeds, I am informed, in the holes of old trees, walls, old buildings, &c., during the hot weather, and is said to have 3 or 4 eggs of a greenish blue colour. It is very often taken when young, and caged, becoming very familiar, and learning to repeat words and sentences with great ease. Its cries are many and varied, most of them harsh, loud and disagreeable, but it has also some sweet and agreeable notes. Length varies from 10½ to nearly 12 inches. Irides reddish brown, studded (as Colonel Sykes remarks) with whitish specks on their external margin; bill and legs yellow; naked skin round eyes, orange yellow.

164.—*P. fuscus*, Wagl. ?—*P. Mahrattensis*, Sykes ?—*Hill Myna.*

This very closely allied species, I have found, in greatest abundance, on the Neilgherries, where it accompanies cattle like the last (whose place it supplies here), and also frequents gardens, eating various seeds, and fruit. I have also seen this species in the Wynaad, and I think, on one occasion, in Mysore. I have united Colonel Sykes' name to that previously given by Wagler, and have little doubt but that they are the same bird. Colonel Sykes however, says " possesses no crest," and Wagler does not mention one, though he probably infers it, as he says, " very similar to *P. Tristis.*" Now my specimens, though they have not the flowing crest of the common *Myna*, have the feathers of the head lengthened, and those of the forehead are somewhat raised, as in *P. cristatellus*.. It has not the naked yellow skin round the eye of *P. tristis*. Length 9 to 9½ inches; wing 5; tail 3; tarsus 1 $\frac{4}{10}$ths; bill to front nearly $\frac{7}{10}$ths; at gape 1 $\frac{2}{10}$ths. Irides greyish white; bill orange yellow; feet gamboge yellow.

165.—*P. pagodarum*, Temm.—*Turdus pagodarum*, Gmel.—*Le Martin Brame*, Le Vaill. *Ois. D'Afr.* pl. 95-2.—*Popoya Myna*, H.—*Brahminy Myna* of Europeans in India.

The Carnatic appears to be the head quarters of this species of *Myna*, as it is the only district in which it can be said to be numerous. I did not observe it in the Northern Circars, nor in the wooded region of the west coast, though I doubt not, that it may occur occasionally in both regions, and in the central table land of the peninsula. I have only observed it rarely, few in number, and in the cold season. In the Carnatic (as about Madras and Trichinopoly) it is extremely abundant, feeds chiefly on the ground, on grasshoppers, and other insects, in small parties, and is very sprightly and active; walking and hopping about, sometimes in company with the common *Myna*, and often seen among cattle. It also, however, feeds on trees, on various fruit, berries and flower buds, and this seems to be its usual habit on the few occasions I have observed it out of the Carnatic. Its notes are somewhat similar to those of the common *Myna*. It has also, however, a pleasant song. Length 8 to 8½ inches; wing $4\frac{2}{10}$ths; tail 2½ to 3; tarsus $1\frac{1}{10}$th; bill (to front) $\frac{6}{10}$ths; at gape 1 inch. Irides greenish white; bill at base blue, then greenish, and yellow at tip; legs bright yellow.

166.—*P. Malabaricus.*—*Turdus Malabaricus*, Gmel.—*Le Martin Vieillard*, Lesson.—*White headed Myna.*

Wagler has committed a capital mistake when he pronounces this to be the adult female of the last, and shews how much caution should be used by naturalists at home, before deciding on the identity of birds, whose general appearance and structure is similar, though in this case the difference of structure, as well as of plumage, might have suggested the contrary opinion. The *white headed Myna* is only found, as far as I am aware, in the lofty jungles of the Malabar coast, frequenting high trees in the more open spaces of the jungle, living in small families, and feeding chiefly on various kinds of insects, larvæ, and in one or two instances, as I found, on small snails. It climbs about the trunk and branches of trees with great facility, and never that I observed, descends to the ground. It has a very sweet song. Mr. Elliot mentions it as found in the forests of the Southern Mahratta Country, but as it is not included in Colonel Sykes' catalogue, it probably does not extend so far to the northward as his district. Feathers of the head and neck beautifully white, and silky in adult specimens. In some birds the white of the neck extends over the breast, and part of the belly, nearly hiding the usual rufous tint of those parts. Irides, greyish white;

bill blue at base, greenish in centre and yellow at tip; legs reddish yellow; claws pale yellow. Length 8 to 8½ inches; wing $4\frac{3}{10}$ths; tail $2\frac{7}{10}$ths to 3; tarsus 1 inch; bill to front $\frac{7}{10}$ths; at gape $1\frac{1}{10}$th.

I may here mention, that I think there exists another species of *Pastor*, nearly allied to this, and differing only in size and in the colour of the head and neck, which are permanently grey, instead of assuming a white plumage. I possess only one specimen of this bird, shot in the Northern Circars, but have seen and shot it in the Carnatic, during the cold season, frequenting the tops of high trees. It may be considered as the young of *P. pagodarum*, but besides the difference of size, and various peculiarities of both plumage and structure, as I never saw it in company with it, and have reason to believe that the young birds of the latter early assume the black colour of the head, I think it certainly distinct. Again it may be considered as the young of the *P. Malabaricus*, to which it has certainly a strong resemblance; but as I never saw that species in the Carnatic, nor in the Northern Circars, I think that this supposition is also unlikely. If distinct, it may be named *P. cinereus*. Is this the *Gracula cinerea* from Bengal, mentioned in Lesson's *Traite?* Length of my specimen 7½ inches; of wing 4; tail 2½; tarsus barely 1; bill to front $\frac{6}{10}$ths; at gape about I inch. Bill and legs as in *Past. Malabaricus*, except that the bill is yellow only at the tip, instead of for more than half its length.

167—*P. roseus*, Temm.—*Turdus roseus*, Gmel., Lath.—*Tillyer*, H.—*Cholum bird* of Europeans in the Carnatic.

This well known species makes its appearance in the peninsula of India about the end of November, or beginning of December: associates in vast flocks, and commits great havoc on the grain-fields, especially in those of *Cholum* (or *Joaree*,) (*Andropogon Sorghum*), whence its common name. When the grain is cut, it occasionally feeds on insects, seeking them on the ground, also on various grass seeds, fruit and flower buds. It disappears in March, though straggling parties are met with even in April. The majority of birds in a flock are in imperfect plumage, the delicate salmon colour of the adult bird being replaced by a dirty fawn colour.

I extract from Mr. Elliot's notes the following interesting observations on this species. "Is very voracious and injurious to the crops, particularly to the white *Jowaree*, in the fields of which the farmer is obliged to station numerous watchers, who, with slings, and a long rope or thong (which they crack dexterously, making a loud report), endeavour to drive the depredators away. The moment the sun appears above the horizon, the *Tillyers* are on the wing, and at the same instant shouts, cries and the cracking of the long whips, resound from every side. The *Tillyers*, however, are so active that if they are able to alight on the stalks for an instant, they can pick out several grains. About 9 or 10 o'clock A. M. the exertions of the watchmen cease, and the *Tillyers* do not renew their plundering till the evening. After sun-set they are seen in flocks of many thousands, retiring to the trees and jungles for the night. They prefer the half ripe *Jowarree*, whilst the farinaceous matter is still soft and milky." Length 9 to 9½ inches; wing 5¼; tail 3; tarsus nearly 1 $\frac{3}{10}$ths; bill to front $\frac{7\frac{1}{2}}{10}$ths; at gape 1 $\frac{1}{10}$th. Irides deep brown; bill orange yellow at the base, then pinkish, and brown at the point; legs dusky reddish.

GENUS GRACULA, L.—EULABES, CUV.

168.—*G. religiosa*, L.—*Koknee Myna*, H.—*Wattled* or *Jungle Myna.*

This species is only found in lofty jungle, as well in the east as on the west coast. It is by no means common, and seems very partially distributed, as you may pass through miles of forest without seeing a single specimen. It is generally found in small parties of five or six frequenting the tops of the loftiest trees, and feeding on fruit and berries of various kinds. I never found that insects had formed any portion of its food. The song of this bird is very rich, varied and pleasing, it has, however, several harsher notes frequently heard in the jungles it frequents. The *Jungle Myna* is now not often seen in cages in the South of India, but it is very highly prized, both for its powers of song and speech, which are said to surpass those of all other birds in distinctness. Irides deep hazel brown; bill and wattles orange yellow; legs bright yellow. Length 10 inches; wing 5 $\frac{6}{10}$ths; tail 2 $\frac{8}{10}$ths; tarsus 1$\frac{2}{10}$ths; bill straight to front 1; at gape 1 $\frac{3}{10}$ths.

It has probably been from erroneous information that this species was named '*religiosa*' by Linnæus, as I am not aware of its being considered sacred by the Hindoos, whereas the *Pastor Tristis*, or *common Myna* is, as I learn from Mr. Elliot's notes, sacred to *Ram-deo*, on whose hand it sits.

FAMILY FRINGILLIDÆ, Finches.

SUB FAMILY COCCOTHRAUSTINÆ, Swains.—*Hard-bills.*

GENUS EUPLECTES, Swains.—PLOCEUS, Auct.

169.—*E. Philippensis.*—*Ploc. Philipensis*, Auct.—*Baya*, H.—*Weaver Bird.*

The weaver bird is found over all the peninsula, but much more abundantly in some situations than in others, being common in the more wooded districts, and though not rare, far from common in the Carnatic, and the bare table land, as you may often pass over large tracts of country without ever seeing it, while in particular spots you find a tolerably large colony of them. The *Baya* associates in numerous flocks, generally builds in company, and almost always in the close vicinity of water. Its long bottle-shaped nest is well known. It feeds on various grass seeds, and also grain, associating sometimes with the *Emberiza melanocephala*, and sometimes as Colonel Sykes observes, with the house sparrows. The flock keeps up a continual chirping. It breeds, I am told, towards the end of the monsoon, and the young ones are ready to fly about the ripening of the first crops of grain. Length about 6 inches; of wing 2 $\frac{8}{10}$ths; tail 2; tarsus $\frac{9}{10}$ths. Irides dark brown; bill black; legs yellowish.

170.—*E. Bengalensis.*—*Loxia Bengalensis*, Auct—*Cocc. chrysocephala*, Vieill.—*Le gros bec Orchef*, Vieill. Encyl. Meth. p. 1008.—*E. albirostris*, Sw.?—*Bahmunee Baya*, H.

I have not myself met with this species, but find it recorded in Mr. Elliot's notes, as found occasionally in the Southern Mahratta Country. That gentleman says that, "the male has the yellow crown only in the breeding season. At other times only eyebrow and ear spot are yellow. Their nests, though similar, are smaller than those of the common *Baya*, and have two chambers. Habits the same as those of the *Baya*. Length 6 inches."

Major Franklin, I see, has ranged this bird, as an *Emberiza*, but says its Indian name is *Baya*, and Mr. Elliot calls it a *Ploceus;* so, although I have not seen it, I range it unhesitatingly as an *Euplectes* of Swainson.

GENUS AMADINA, Swains.

SUB GENUS ESTRELDA, Swains.

171.—*E. amandava.*—*Fringilla amandava*, L.—*Lal* (the male), *Mooneah* (the female), H.

This pretty little bird is far from being common in the South of India. I have seen it in greatest abundance on the top of the Neilgherries, where it frequents meadows and bushy ground, but frequently also enters gardens, and is considered destructive to various seeds, buds, &c. I have seen it only once or twice in the Deccan, in the neighbourhood of well wooded towns. It is said to be common in some parts of Mysore. Mr. Elliot says, "It is common in Dharwar, particularly in the sugar-cane fields, along with *Spermestes Malacca.* Though I have never myself observed it in the Carnatic, I am informed it is met with in some districts, especially about Arcot, and that it builds its nest of well woven grass, attaching it to a stalk of *rawala.* It is caught in great quantities in certain parts, and kept in cages with the next and other species. It is said to fight with great courage (for which purpose it is kept by the natives), and that it will continue the combat till blood is drawn on one or both sides. Length 4¾ inches; wing 2; tail 1½; tarsus rather more than ½ an inch; bill to front $\frac{3}{10}$ths.

SUB GENUS SPERMESTES, Swains.—LONCHURA, Sykes.

The next four species most probably belong to Swainson's genus *Spermestes*, though they are probably aberrant species, leading to *Erythura*, by their slightly acuminated tail.

172—*S. nisoria*, Temm. P. C. 500-2.—*Loxia punctularia*, Auct.?—*Sing baz* or *sheen baz*, H.—*Chesnut throated finch.*

I have hitherto only found this pretty species on the Neilgherries, frequenting long grass and bushes, and feeding on various seeds in small parties of 4 or 5. I am informed, however, that it is met occasionally in various parts of the country, as in Mysore, and some of the more wooded spots, near large towns in the table land. It is enumerated both in Mr. Elliot's and Colonel Syke's catalogues. The upper tail coverts have a strong yellow tinge, and a glistening waxy sort of lustre. Bill and legs, slate blue; irides dark brown. Length 4½; wing 2$\frac{2}{10}$ths; tail 1½; tarsus $\frac{6}{10}$ths; bill at front $\frac{4}{10}$ths.

173.—*S. leuconota.*—*F. leuconota,* Temm., P. C. 500—1.—*Lox. striata,* Lath. ?—*White rumped Finch.*

I have only hitherto observed this species in the Malabar coast, and the Wynaad, frequenting grain-fields, open spaces in the jungle, and occasionally seen on the road-side, and even in stable yards, feeding on various kinds of grain and seeds. It lives in small flocks of six, eight or more. Irides dark brown; bill and legs, slate blue. Length $4\frac{4}{10}$ths; wing $2\frac{1}{10}$th; tail $1\frac{6}{10}$ths; tarsus $\frac{5\frac{1}{2}}{10}$ths; bill to front $\frac{4}{10}$ths.

174.—*S. Malacca.*—*Loxia Malacca,* Auct. ?—*Nukl-nore,* H.—*Black-headed Finch.*

The *nukl-nore* so nearly approaches the description of the *Loxia Malacca* of authors, that I shall here consider it as the same. I have seen this bird in the Carnatic, frequenting long reeds and grass, by the side of rivers, in the table land in similar situations, though more rare, and most numerous in the wooded region of the west coast, frequenting grain-fields in large flocks along with the last species.

I shall here add a brief description. Male,—head, neck and breast of a rich black; body above of a chestnut brown; the upper tail coverts of a brighter tinge, and with a glistening lustre, as in *S. nisoria,* belly white with large central spot and vent black; bill bluish at base, yellowish at tip; legs plumbeous. Length $4\frac{3}{4}$; wing $2\frac{3}{10}$ths; tail $1\frac{4}{10}$ths; tarsus $\frac{6\frac{1}{2}}{10}$ths; bill at front $\frac{4\frac{1}{2}}{10}$ths. Irides dark brown. Female—or young ?—above of a pale cinnamon brown, darkest on the head; beneath rufous white, darkest on throat and neck.

175.—*S. cheet.*—*Lonchura cheet,* Sykes.—*Pidderee,* H.—*Small brown Finch.*

This plain coloured little *finch* is found all over the peninsula, living in families, and frequenting hedges, low trees in cultivated ground, and low bushes on the open plain, or by a river side. It frequently enters gardens, and feeds on various kinds of seeds. Colonel Sykes describes its nest as being formed of grass, in the shape of a hollow ball, and that he found in one nest ten white eggs, not much larger than peas. Irides deep brown; bill bluish; legs dirty reddish. Length about 5 inches; tail 2.

SUB FAMILY FRINGILLINÆ.—*Ground Finches.*

GENUS PYRGITA, Swains.

176.—*P. domestica.—Chooree,* H.—*Common House Sparrow.*

The *Sparrow* is found all over India, even its hottest parts. It is least common on the wooded west coast, and Quilon is said to be exempt from its society, as well as from that of the common squirrel (*Se. palmarum*), two of the greatest pests of most other stations.

177.—*P. flavicollis.—Fringilla flavicollis,* Frankl.—*Rujjee,* H—*vulgo Junglee chooree,* i. e. *Jungle Sparrow.—Yellow necked* or *Jungle Sparrow.*

The *yellow necked sparrow* is found all over the peninsula, wherever there are abundance of trees, but it cannot be said to be a common bird any where, even in the well wooded region of the west coast, where it is more plentiful than in any other part of the peninsula. It frequents thin jungle, groves of trees, avenues, &c.; lives in small flocks, and has almost exactly the same chirping note as the common sparrow. It feeds on various seeds, grain and flower buds. It is said to breed in holes of trees. Mr. Elliot says "also breeds on old pots, and on house tops." The egg is of a greenish white, much streaked and blotched with purple brown. I obtained one from the body of a female. Colonel Sykes has placed it as a *Ploceus*, but its habits, as well as its structure, and the similarity of its notes to those of the common sparrow, have led me to replace it among the sparrows. Length 5½ inches; wing 3$\frac{3}{10}$ths; tail 2; tarsus $\frac{7}{10}$ths; bill to front $\frac{4}{10}$ths; bill black; legs cinereous; irides brown.

178.—*P.? concolor.*—New species.?

I have but a single specimen of the bird I am about to describe, which was shot on the ground in an open plain, along with a lot of the *Indian Ortolan* (*Alauda Dukhunensis,* Sykes). It does not exactly agree with the characters of *Pyrgita,* having the bill more turgid, and with the commissure slightly sinuated. The third quill is shorter than the two first, and the inner toe is shorter than the outer one, its claws moreover are less curved. I cannot, however, range it under any other of Swainson's genera, so prefer retaining it here.

Descr.—Of an uniform light ashy brown colour, lightest below (almost white indeed at chin and vent), and darkest on the quills and tail. Length 6 inches; wing $3\frac{8}{10}$ths; tail $2\frac{1}{4}$; tarsus rather more than $\frac{7}{10}$ths; bill at front $\frac{4}{10}$ths. Irides brown; bill brown above, yellowish below; legs flesh coloured yellow.

GENUS EMBERIZA, Auct.—*Bunting.*

179.—*E. melanocephala*, Auct.—*Gundum*, H.—*Black-headed Bunting.*

I do not recollect having seen the *Gundum* in the Carnatic. It makes its appearance on the table land, about the end of November, or beginning of December; associates in numerous flocks, and is very destructive to grain-fields. Few of the birds are found in perfect plumage. Length $7\frac{1}{4}$ to 8 inches; wing $3\frac{8}{10}$ths; tail 3; tarsus $\frac{9}{10}$ths; bill to front $\frac{5}{10}$ths.

180.—*E. ortolana*, Auct.—Sykes' Cat.—*Ortolan* of Europe.

I have not hitherto met with the *Ortolan* of Europe.

181.—*E. cia ?*—*Putthur Chirta*, H.—*Bush or hedge Bunting.*

Though I have great doubts whether this bird is the *E. cia* of authors, yet as it approaches nearly the description of that bird, and moreover is only a winter visitant to the peninsula, I think it may turn out to be identical with it.

This *bunting* is found only in the more northern parts of the table land, during the cold weather, frequenting hedges and trees in the neighbourhood of cultivation, also bushy wilds. It feeds on various grains and seeds. Found sometimes single or in pairs, at times in numerous flocks. I shall add a brief description.

Plumage above cinereous, tinged with reddish on the back and rump; beneath lighter cinereous, strongly tinged with reddish fawn colour, on throat and breast, passing into reddish white, or pale fawn colour on the belly and vent; chin whitish. Wings and tail dark brown, broadly edged with reddish fawn; outer feathers of the tail white on their inner webs. Irides brown; bill reddish; feet yellow. Length $6\frac{1}{2}$ inches; wing $3\frac{1}{2}$; tail $2\frac{1}{2}$; tarsus $7\frac{1}{2}$ tenths; bill to front hardly $\frac{4}{10}$ths.

182.—*E. cristata*, Vigors.—Sykes' Cat.—*Crested black Bunting.*

183.—*E. sub-cristata*, Sykes' Cat.—*Crested brown Bunting.*

I have not hitherto been fortunate enough to observe either of these species of *Bunting.*

Sub Family ALAUDINÆ.—*Larks.*

Genus ALAUDA, L.—*True Larks.*

There is great difficulty in making out the species of this genus from description (unless they are very minutely described both as to structure and colour), as they are all clothed in such similar plumage, and I do not feel confident that I am referring the species I have observed to their proper places, and therefore wish that my remarks may only be considered as an approximation to the truth, till the specimens have been examined and compared at home.

184.—*A. Gulgula*, Frankl.—Sykes' Cat.?

The only specimens I possess, of what I consider to be this bird, were shot on the Neilgherries, where they are very abundant. Colonel Sykes says this is the *chundoola* of India, but the bird which is so frequently caged and kept by natives under that name, answers more to the description of his '*A. Deva*'. One of my specimens differs slightly from the others in having the tail feathers more acuminated, a rather longer beak, and longer wing. This specimen agrees with the measurements of Colonel Sykes, viz. total length $6\frac{7}{10}$ inches; tail $2\frac{3}{10}$ths; wing of this $3\frac{8}{10}$ths. Of another specimen the tail is only 2 inches, and the wing $3\frac{6}{10}$ths. In both the hind toe alone is $\frac{4}{10}$ths; hind claw $\frac{7}{10}$ths; nearly straight. Whether these differences are accidental or not, I shall not here attempt to determine. Irides brown. Chief food grasshoppers, tipulæ, and other insects.

185.—*A chendoola*, Frankl.—*A. Gulgula*, Sykes?—*Aggun*, H.

I do not possess a specimen of this bird, but have seen and cursorily examined some living birds lately. The *Aggun* of India is very common in the Carnatic, and also in the Northern Circars, I believe, but is rarely, if at all, met with on the great table land of Southern India. Having neglected to obtain specimens whilst in the Carnatic, I cannot give my minute details regarding it. Its shade of plumage is less rufous and more grey than that of the last, or of the next species: the central marks of the feathers also are not so dark, the shade of the plumage beneath is greyish or earthy rather than rufous white, and the chin is pure white. Its bill too is much thicker and stronger than that of the last. The ***Aggun*** is frequently caught when young, and caged for its song, which is said to be very sweet; it also imitates the notes of other birds, but not so well as the next species. As I have never seen the first species (No. 183), except on the Neilgherries, I think that this may perhaps be the *A. Gulgula* of Sykes' Cat., but again the fact of the ***Aggun*** not being observed by me on the table land, and being considered as unknown here by the natives, renders this improbable.

186.—*A. deva*, Sykes.—*A. Gulgala*, Frankl.—*Cherundool* or *Chundool*, H.

This well known species appears to answer pretty exactly to the description by Sykes of his '*A. Deva*'. I suspect it may turn out to be the *A. Gulgula* of Franklin, as it appears to be more generally spread over India than any of the others.

The *Cherundool* is found all over the peninsula, but is more common in the table land than below the ghauts. It differs from the two former species in its smaller size, and especially in the form of its crest; for whilst in the two last, the crest is composed of nearly all the feathers of the head, being slightly elongated, and all capable of erection; in this bird the crest is merely confined to a few of the feathers of the forehead, the centre feathers of which especially, are much elongated, and partially acuminated, and when raised form a very elegant pointed frontal crest, which is raised at will nearly upright, the feathers of the top of the head and occiput remaining perfectly smooth. The shades of its plumage are almost exactly similar to those of the first species, its bill, however, is much stronger in proportion. The *Cherundool* is very frequently caged in all parts of the country, and the bird is kept in darkness by several layers of cloth being wrapped round the cage, the custom being to wrap an additional covering round the cage every year. In this state it sings very sweetly, and learns to imitate most exactly the notes of various other birds, and animals even, such as the yelping of a dog, the mewing of a cat, &c. &c. It feeds on various insects, chiefly grasshoppers, and in default of this food on various grains and seeds. Irides brown. Length 6 inches; of wing 2 $\frac{4}{10}$ths; tail 2$\frac{3}{10}$ths; tarsus about 1 inch; hind toe alone $\frac{3}{10}$hs; claw $\frac{4}{10}$ to $\frac{5}{10}$ths.

187.—*A. Dukhunensis*, Sykes.—*Emberiza Baghaira*, Frankl. Cat. ? *Baag-geyra Lark.*—*Latti ? Baghaira* or *Baghōda* of some *Shikarees*, H.—*Ortolan* of Europeans.—*Social Lark.*

This bird as described by Sykes, is most probably the *Emb. Baghaira* of Franklin's catalogue, but as the only description of the *Baag-geyra Lark* I have access to, is very brief, I cannot be certain. This bird appears on the table land of India in October. It associates in vast flocks, frequenting the bare grass downs, and is fond of damp spots, as at the edge of tanks, &c. It also frequents grain-fields, and almost always retires to them for shelter during the heat of the day, from whence it does not in general issue again till next morning. They are so numerous occasionally, that 4, 5 or 6 dozens are sometimes killed at a shot, and numbers are often netted in some parts of the country, as I learn from Mr. Elliot's notes. When in good condition it is highly esteemed for the table. The *social lark* does not breed in this part of India, and quits it for the north in March. Irides deep brown. Length 6¼ inches; of wing 4; tail $2\frac{2}{10}$ths; tarsus $\frac{9}{10}$ths; hind toe alone hardly $3\frac{1}{10}$ths; claw about the same.

GENUS MYRAFRA, Horsf.—*Thick billed Lark.*

188.—*M. phœnicura*, Frankl.—*Reytul*, H. of some; *Ageea*, H. of others.—*Red bellied lark.*

The *red bellied lark*, is found over all the peninsula, but is much more common in the Deccan, than below the ghauts. It frequents the open plains, preferring the barest spots, ploughed land, stubble fields and beds of nullahs. It sometimes, though rarely, perches on bushes. Its habits are much those of the *Larks.* It feeds chiefly on seeds of various kinds, also on insects occasionally. Its abrupt jerking flight has been already noticed by Colonel Sykes. It frequently ascends suddenly in the air by a few interrupted strokes of its wings, and uttering at the time a pleasant loud whistle-like note, sounding something like *Too whee*; it then descends with a sudden fall, changing its note to a low lark-like warbling; when close to the ground it again repeats this, and so on for several times. Irides brown; bill horny above, flesh coloured below; legs flesh coloured. Length 6 inches; wing $4\frac{2}{10}$ths; tail $2\frac{4}{10}$ths; tarsus $\frac{9}{10}$ths; hind toe alone $\frac{3}{10}$ths; claw the same, nearly straight; bill to front $\frac{3}{10}$ths; gape $\frac{7}{10}$ths.

189.—*M. Javanica?*—*Ageea,* H. of some, *Junglee Ageea* of others.—*Red winged Lark.*

As I have no description of *M. Javanica,* I merely refer my bird to that species at a venture, but think, as it is mentioned in Franklin's catalogue, it is probably the same. I have only observed this species among stony and bushy hills, and low jungly plains in the northern part of the Deccan. It is never found on the bare plains like the last. It is found single or in pairs, is a wary bird when roused, flying a short distance, and seating itself behind a bush on the ground, or perching on the back part of the bush, which it does much more frequently than the last. Feeds on various seeds. I add a brief description. Above of a reddish brown or fawn colour, of various intensity; the feathers centred darker, and edged with lighter. Feather of head elongated, bright rufous fawn; centred with brown; quill feathers cinnamon rufous, tipped with dusky, tail brown, centre and external feathers edged with rufous. Beneath white, breast spotted with brown. Irides dark brown. Length 5½ inches; of wing 3 $\frac{2}{10}$ths; tail 2; tarsus $\frac{8\frac{1}{2}}{10}$ths; hind claw alone $\frac{3}{10}$ths, longer than its toe; bill at front $\frac{4}{10}$ths; to gape $\frac{5}{10}$ths.

GENUS AGRODOMA, Swains.—ANTHUS, Auct.—*Tit Lark.*

190.—*A. agilis.*—*Anthus agilis,* Sykes.—*Roogail,* H.—*Common Tit lark of India.*

Although by no means certain that this is the '*A. agilis*' of Sykes, yet as it is the most common species in India, I have ventured to consider it as such, adding a brief description for the sake of comparison. The *Roogail* is tolerably common over all India, frequenting the open grass downs, stony plains, and also not unfrequently the beds of rivers, tanks and other moist places. It runs swiftly along the ground, and when raised takes but a short flight. It feeds chiefly on various insects. It probably represents the *A. pratensis* of Europe, to which it appears to have a very close resemblance, but Colonel Sykes has pronounced them distinct.

Descr.—Above light olive brown, the feathers centred with a darker shade; beneath of a reddish or earthy white; the breast striated with brown lines; and a narrow line of same colour down each side of the throat.

My specimens vary in size from 6¼ to 6¾ inches; wing 3$\frac{5}{10}$ths; tail

$2\frac{1}{2}$; tarsus $1\frac{1}{10}$th; hind toe alone $\frac{4}{10}$ths; do. claw (slightly curved), nearly $\frac{5}{10}$ths; bill to front $\frac{4\frac{1}{2}}{10}$ths; at gape $\frac{7}{10}$ths. Irides brown; legs flesh coloured. I have one specimen not differing in colour, the wing of which is only $3\frac{9}{10}$ths; hind claw perfectly straight, and the hind toe only about $\frac{3}{10}$ths of an inch. Is this a mere variety?

191.—*A. rufescens.—Anth. rufescens,* Auct.?—*Hill Titlark.*

This bird which approaches very closely the descriptions of the *A. rufescens* of Europe, I have hitherto found only on the grassy hills of the Neilgherries, where it is tolerably common. It runs briskly along the ground, and flies only a short distance. On one or two occasions, I observed it perch on a tree. I found its food to consist of various insects.

Descr.—Above of an olive yellow; the feathers centred with dark brown; beneath and superciliary mark of a light rufous tinge, darkest on the breast, which as well as the sides and belly are streaked with brown. Length $6\frac{4}{10}$th inches; wing $3\frac{8}{10}$ths; tail $2\frac{1}{2}$; tarsus nearly 1; hind toe alone nearly $\frac{5}{10}$ths; do. claw $\frac{4}{10}$ths, fully curved; bill shorter and stronger than in the other species. Length to front $\frac{4}{10}$ths; at gape $\frac{6}{10}$ths.

192—*A. rufula.—Anth. rufulus,* Vieill. Ency. Meth. p. 326.?—*Chilloo,* H.—*Pale* or *rufous Titlark.*

As the description of the *Anthus rufulus* of French authors, appears somewhat to coincide with my specimens, I have for the present considered them as the same. The *Chilloo* of *Shikorees* is tolerably common on the bare stony plains of the table land: I am not aware if it is also an inhabitant of the Carnatic. It has similar habits to others of the genus.

Descr.—Above of a pale rufous grey tint; the feathers centred with dusky, most distinctly on the head, hardly at all on the back and rump, beneath and superciliary stripe, pale fawn colour, whitening towards the vent and on the chin; breast very faintly marked with pale brown streaks; a brown stripe runs from the gape below the ear, and another from the lower edge of the under maudible, down the throat on either side. The wing coverts are brown, very broadly edged with fawn colour. The two centre feathers of the tail are also brown, edged with fawn, the external nearly all of that colour, the next to it tipped and edged only, and the remainder all deep brown. Irides brown; bill

horny above, pale fleshy below; legs flesh coloured. Length nearly 7 inches; wing $3\frac{6}{10}$ths; tail about 3; tarsus 1; hind toe alone $\frac{3}{10}$ths; hind claw rather more than $\frac{3}{10}$ths; more curved than in *A. agilis;* bill to front $\frac{5}{10}$ths; at gape $\frac{7\frac{1}{4}}{10}$ths.

193.—*A. similis.*—New species?—*Large Titlark.*

Descr.—The description of the last species will apply exactly to this very similar bird, with this exception, that the centre markings of the feathers are still more indistinct in this one; and that the fawn colour of the plumage beneath, extends over all the abdomen, vent, and under tail coverts. It differs, however, remarkably in size and in some points of structure. Length $8\frac{1}{4}$ inches; wing $3\frac{8}{10}$ths; tail $3\frac{6}{10}$ths; tarsus $1\frac{1}{10}$th; hind toe alone $\frac{4}{10}$ths; hind claw $\frac{4}{10}$ths; more curved than in *A. rufula.* Bill at front $\frac{6}{10}$ths; at gape $\frac{9}{10}$th. Besides the structural differences shewn in these measurements, this differs from the last in the bill being slightly curved, both at the culmen and commissure. Irides brown; legs flesh coloured. I only once observed this large *Titlark* in an open stony plain, there were a pair of them together, and I noticed that their flight was performed somewhat differently to that of the *Titlarks* in general, there being a more frequent flapping of the wings. I found fragments of insects in the specimen I then procured.

GENUS MEGALURUS, Horsf.

193.—bis.—*M. ruficeps,* Sykes.

I have not hitherto observed this species.

SUB FAMILY PYRRHULINÆ, Swains.

GEN. PYRRHULAUDA.—*Finchlark.*

194.—*P. cruciger.*—*Fringilla cruciger,* Temm. P. C. 260. 1.—*Alauda Gingica,* and *Duree Finch,* Lath.—*Emberiza Gingica,* Gmel.—*Decora,* H. *vulgo.*—*Dubhuk Choree* i. e. *Squat Sparrow.*—*Black bellied Finchlark,* or *Squat Finch-Ortolan* of some Europeans.

This curious little bird is extremely common in all parts of India, frequenting the open plains and cultivated grounds, and common on roads or any other bare spots of ground. Its habits are quite those of a *lark*. It is still more remarkable than the *Mirafra phœnicura*, for the sudden ascents and descents of its flight, mounting up some height by a few flappings of its wings, and then descending almost perpendicularly till close to the ground, when it again rises as before, and repeats this several times. In general, it takes but a short flight, and on alighting, squats so close that, as Colonel Sykes remarks " it almost allows itself to be ridden over ere it rises." It occasionally may be seen seated on a house top, but I never saw it perch except on one occasion, when I observed some 12 or 15 of them perched on a low tree close to a house in cantonment. This was during the height of the hot weather. I was fortunate enough to obtain the nest and eggs of this bird very lately (in February). The nest is composed of woven thread, mingled with some fibres of grass, and one or two small fragments of cloth. The sides are hardly raised at all, it was placed in a slight hollow on the open plain near a river, and contained two eggs of a slight greenish grey tint, spotted with brown, chiefly at the larger end. Length 4¾ inches; wing 3; tail 1$\frac{6}{10}$ths; tarsus $\frac{8}{10}$ths; hind toe and claw $\frac{4}{10}$ths; bill to front $\frac{3}{10}$ths; at gape $\frac{4}{10}$ths. Irides reddish brown; bill flesh coloured, with a tinge of horny; legs flesh coloured.

Genus HÆMORHOUS, Swains.

195.—*H.* ? *roseus*—*Coccothraustes rosea*, Vieill. Encly. Meth. p. 1010 *Ois. Chant*, pl. 65.—*Fringilla rodopepla*, Vigors ? Gould's Cent. Him. Birds.—*Loxia Madagascariensis*, and *Lox. Totta* of English authors *Tootee*, H.—*Rose Finch*.

I am not quite certain if the *Rose Finch* of India belongs to Swainson's genus *Hæmorhous* or not, but as far as I can make out, it appears to do so. It appears to be the species named as above by Vieillot, and if so, the name of *F. rodopepla* must sink to a synonym. The *Tootee* of India arrives in this country from the north, about November, and remains till March. I first saw it in thick jungle at the bottom of the Conoor pass, busily engaged in eating the seeds of the lofty bamboos there. I have seen it also several times in large groves of trees in the northern part of the table land. It associates in flocks of various numbers, and devours various grains, especially *Jowaree* (*Andropogon Sorghum*), and also rice, and in default of these, various other grains, seeds and even flower buds, and young leaves of trees. It is occasionally caught and domesticated on account of its song, which is said to be very sweet. Vieillot says "it is often brought from India alive, and bears the climate well." It is said not to be bred in any part of India. Irides brown; bill and legs pale brown. Length 6½ inches; wing 3$\frac{8}{10}$ths; tail 2¼; tarsus not quite $\frac{8}{10}$ths.

FAMILY BUCERIDÆ.—*Horn bills.*

GENUS BUCEROS.—*Horn bill Toucan* of residents in India.

196.—*B. Cavatus*, Shaw.—Gould's Cent. Him. Birds.—*Garuda* of the natives of the forests.—*Malah-moraykey*, Mal.—*Largest Horn bill.*

I have not myself been fortunate enough to procure a specimen of this *large Hornbill*, but have seen it on several occasions in the thick jungles of Malabar, and in the Coonoor pass of the Neilgherries. I take the following account of it from Mr. Elliot's notes, who met it in the Soonda jungles.

Descr.—"Back, wings, belly, chin and bar on the tail black; neck, tail, thigh, wing spot, tips of scapulars and remiges white; bill vermilion above, passing into yellow, the lower mandible whitish, at the base black. The male bird has the space between the prominence and the true beak in front also blackish, from which a black stripe runs down the crest of the beak, towards the point, and the posterior termination of the prominence is also dusky in the male, red in the female." Length—male upwards of 4 feet; female 4 feet; weight of the latter 6¼ lbs; bill from point to gape in a straight line 10 inches; from point to end of protuberance 13¼ inches; protuberance 7½ inches long; 3¼ broad.

"At the root of the tail of this bird on upper side, immediately above the vent, is a small sac, in which is a bundle or pencil of short bristles, forming a brush, from which exudes a yellow oily secretion, with which the bird appears to dress the white wing spot; when first shot the yellow colour comes off the bill in considerable quantities, and the only parts of the body besides, that are stained with this colour, are, the wing spot, rump, and the small crest on the back of the head; this latter but slightly. This yellow substance continued to exude from the brush, long after the specimen was prepared and dry. The *Garuda* is sacred to *Vishnoo*, among the inhabitants of the forests, as the *Brahminy Kite* is in the open country."

This *Hornbill* is very shy and difficult to approach. The noise of its wings when flying is very loud, and can be heard a long way off. The Malyalum name signifies, I am informed, "*That makes the jungles resound.*"

197.—*B. Malabaricus*, Gmel., Lath.—*B. Albirostris*, Shaw, Wagler.—*Dhanesa*, Sanscrit.—*Dhanchooree*, H.—*Ibba Hakee*, Can.

This *hornbill* is to be met with wherever there is lofty forest jungle, and of course is most plentiful on the Malabar coast, but even here it is far from being a common bird. It lives in parties of four, five, six or more, and lives on fruit and berries of different kinds. Length of one specimen from forehead to tip of tail 31 inches; of wing 13¼; tail 14; tarsus $2\frac{6}{10}$ths; of bill straight to gape 6½ inches; of protuberance alone 6½; from tip of bill straight to posterior angle of the protuberance 8½ inches.

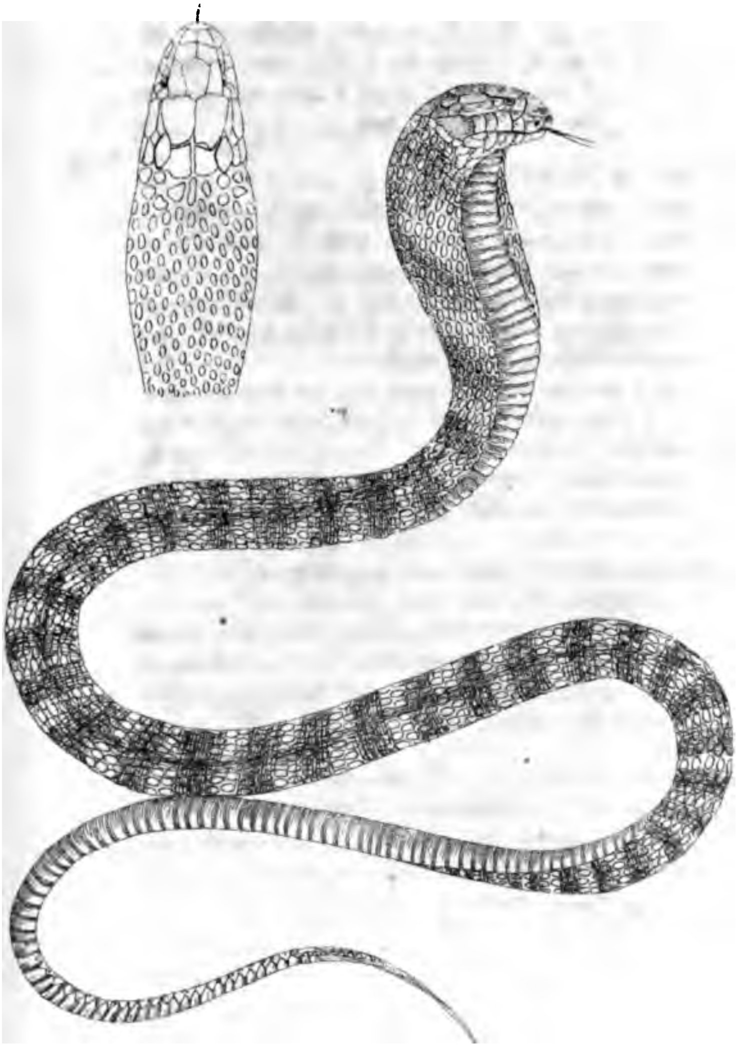
198.—*B. Gingianus*, Lath.—*B. Oxyurus*, Wagl.—*Chakrotra*, H.—*Common Grey Hornbill.*

This bird is spread all over the peninsula, frequenting not only jungles, but also not unfrequently large groves of trees and avenues (in the more wooded parts of the open country). Like the last, it is generally seen in small parties or sometimes single. I have generally found fruit in the stomach of this bird, but on one occasion I found some large insects, chiefly mantides. Length from forehead to tip of tail 22 inches; of wing 8; tail 10; tarsus 2; bill straight to gape 4 inches.

199—*B. Gingalensis*, Shaw.—*B. Pyrrhopygus*, Wagl.—*Kooldal Hakee*, Can.—*Jungle Grey Hornbill.*

I have hitherto only seen this species but once or twice, frequenting lofty jungles in the Malabar coast. I found its food to consist of various kinds of fruits and berries. Bill whitish yellow; total length 22 inches; wing 8¼; tail 8½; tarsus $1\frac{8}{10}$ths; bill straight to gape 4¼; breadth at base $1\frac{3}{10}$ths.

(*To be continued.*)



Naia Vittata

II.—*Description of a new species of Naga, or Cobra de Capello.*—*By* WALTER ELLIOT, ESQ.

In the beginning of January last, a fisherman from one of the Coopums near St. Thome, brought me a box, containing a snake which he said he had picked up, floating in the sea, a few days before, when fishing in his catamaram. The lid was fastened and on opening it, he was astonished to find a *nāg* snake. Perceiving it to be of unusual size, and to differ from the common kind in the distribution of the colours, I immediately bought it, and sent for a snake catcher, who took it out, and displayed it more fully to view. It appeared dull and languid, but was roused and expanded its hood. Its great length, the peculiar shape of the hood, or dilatation of the neck, and the circumstance of its being marked with numerous dark transverse bands, three of which extended across the enlarged portion of the neck, seemed to indicate it, as a species altogether different from the common sort.

It may be described in detail, as a species of cobra or naga, with the head scarcely broader than the neck, the crown depressed, and sloping to the muzzle, which is somewhat obtuse, and covered with 14 more conspicuous plates or laminæ. The first, forming the point of the nose, is semicircular, the next two between the nostrils are sub-triangular, the sides rounded; another pair succeeding these are broader and squarer. Between the eyes are three plates, larger than any of the preceding, sub-conical, the base of the centre one being placed anteriorly, those of the lateral ones posteriorly. The pair behind these are the largest of all, of an oblong shape, broader in front, and sloping from the middle of the exterior edge, to the posterior end: these are succeeded by a smaller broad oval pair, at the lateral junction of which with the preceding pair, are two others, distant and divided, which are about the same size as the last, sub-triangular and rounded. The gape is large; the teeth in the lower jaw sharp, reflex and moderately strong, those in the upper are smaller, and forming two rows along the palate; the larger fangs had been removed. The eyes are small, situated under and about the centre of the inter-ocular laminæ. When the animal is at rest, the neck is slightly smaller than the head, but when roused, it is capable of dilatation, like that of the cobra de capello: but the enlargement, instead of being broader near the head and sloping as it recedes, as in that species, is broadest in the middle and slopes gradually to the head and to the trunk. It is quite destitute of the spectacle mark, but is crossed by three of the transverse dark bands, characteristic of it as a distinct species.

The body is round, covered with oblong, oval scales, distinct, close, but not imbricate. The length 10 feet 1½ inch, of which the tail forms about two feet. The abdominal plates or scutæ are long and 236 in number, the sub-caudal scutellæ are about 84 (?) pairs. The colour above was a pale yellowish brown, with a strong bluish grey tinge on the upper parts of the body, marked with numerous broad dark bands, in number 64. The animal appeared to be languid and weak, as if about to change its skin; it did not eat, and a frog which had been put up with it in the box, hopped away unmolested. For this reason, the colours when in health may differ from those here stated. The accompanying sketch was made the first day I procured the animal, and I had no opportunity of comparing it carefully in detail; for, a few days afterwards, it died, during my absence at Guindy, and had begun to decompose before it was discovered to be dead. An indifferent preparation has been made of its skin.

The group of Naias, or Nagas, forms a subdivision of the genus *Vipera* of Daudin (who separated the poisonous serpents with insulated fangs from the Linneæn genus *Coluber*), in the Regné Animal of Cuvier, distinguished as having "the head furnished with plates and the anterior ribs susceptible of being raised up, and drawn forwards, so as to dilate that part of the trunk into a disc, more or less broad." But a German Naturalist, Fitzinger, has formed them into a separate genus under the name of Cobra.

The most celebrated species that have been described, are the *Coluber Naia* of Linné, or *Naià Tripudians* of Merrem, common both to India and South America, and the *Col. Haje* of Egypt, also described by Linné and Geoffroy. Both of these differ entirely from the present species. Of the Indian cobra, Russell* notices eleven varieties, varying only in circumstances of colour and in the presence or absence of the spectacle mark on the neck.

In Gmelin's edition of the Systema Naturæ, four varieties of the *Coluber Naia* are noticed on the authority of Laurentini,† a German writer of the last century, who seems to have borrowed them from Seba.

These are—1. *Naia Fasciata*, Seba, vol. II, tab. 89. f. 3.
2. *N. Seamensis*, ib. f. 1. 2.
3. *N. Maculata*, ib. tab. 90. f. 2.
4. *N. Brasiliensis*, ib. tab. 89. f. 4.

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* Indian serpents, p. 7. pl. 5, 6. Part i, and pl. 1. Part ii.

† Specimen Medicum exhibens Synopsis Reptilium emendatum, Auctore J. N. Laurentini; Vienna 1768.

the last of which is adopted as a new species, under the name of *N. Rufa.*

On referring to Seba's work in the Society's Library, the following notices of the *Naga* group are found in vol. ii. at plates 84, 89, 90, 94, 97. All of these have the spectacle mark on the dilatation of the neck, except No. 1, of plate 90, and No. 2 of pl. 97, which are called females, a supposition that has since been proved by Dr. Hunter to be erroneous, and that they are merely varieties of the *Col. Naia.* Two others with the spectacle mark No. 1 in pl. 85, and No. 4 in pl. 97, are said to want the faculty of distending the neck, or to possess it in a very slight degree.

Nos. 3 and 4 of pl. 89, resemble the present specimen in the circumstance of having the body marked by transverse bands, the former throughout its whole length (whence Laurentini's specific name of *fasciata*), and the latter for about ⅓rd of its length. But both have the spectacle mark on the neck distinctly represented, the latter of a more than usual complicated pattern. Seba's description of No. 3, is "Indian serpent with a spectacle mark, elegantly ringed."

"Its whole body, of a pale cinereous yellow, is encircled, from the head to the very end of the tail, with reddish brown rings, some of which are narrow, others broader. The order which the Creator has observed in disposing these rings is such, that three of the narrow rings are interposed between every two of the broad ones, a phenomenon certainly most worthy of remark."*

But no such arrangement is observable in the present species, and this, together with the absence of the spectacle mark, and more especially its great size, which could not have failed to have been noticed, seems to establish it a new species: in which event it might with propriety be named *Naia Vittata,* the term *fasciata* having already been appropriated to another, though an unascertained species.

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* Num. 3. *Serpens, Indicus, cum. Conspicillo, lepidè circulatus.*

Totum hujus corpus, ex cinereo dilutè flavum, tenuibus, partim & latiusculis, annulis, fusco-rubris, à capite ad caudam usque ultimam ambitur. Ordo, quem summus rerum Conditor in digerendis hisce annulis observavit, talis est, ut bini annuli, latiores, tres semper alios tenuiores intercipiant, phoenomeno certè animadversione dignissime. Seba Thes. ii. p. 25.

III.—*A cursory Notice of the Gold Tract in the Kupputgode range—Manganese Mines near Wodoorti—and Flint excavations in the Southern Mahratta Country—the Corundum Pits of the western part of Mysore, and the Diamond Mines of Kurnool.—By Lieut.* T. J. NEWBOLD, 23*d Light Infantry.*

Gold tract in the Kupputgode range.—Passing recently through the Southern Mahratta Country, I was informed at D.rwar by Mr. Pelly, Assistant Collector, and by Trimulrow, a brahmin youth, whose acquirements, and thirst after knowledge, do infinite credit to the tuition of the talented president of the Bombay Branch of the Royal Asiatic Society—the Rev. Dr. Wilson—that gold had been lately discovered in the Kupputgode range, near the eastern frontier. I determined on visiting the spot, more especially as my intelligent friend Trimulrow, who has the merit of having first brought to the notice of Government the existence of gold in the particular locality of Doni, had not been able to witness personally the actual extraction of the gold from the sands of the rivulet, whence the specimens of the metal were brought him. Doni, I found to be a small village, about two or three miles south of the fort of Dummul situated on the right bank of the rivulet, in whose sands the gold is found, immediately opposite. Although the *jalgars* (gold washers), were not at work, in consequence of the rivulets not having been lately flooded, I caused some of the natives on the spot to wash two or three baskets of the sand in my presence; and, after about five minutes labour, succeeded in obtaining five or six particles of gold dust. The process of washing has been often described, and does not differ much from that I have seen practised by the Chinese gold washers at the foot of mount Ophir, exchanging the conical vessel for a hollowed board: after the lighter particles of the sand are washed off, the gold dust remains mingled with a heavy black sand (No. 1), most of the particles of which are strongly affected by the magnet, and which does not differ from the granular magnetic iron ore of mineralogists: others are feebly magnetic; these, from their behaviour with fluxes before the blow-pipe, and their gunpowder-like appearance, I take to be menachanite (No. 2), probably derived from the decomposition of the dykes of basaltic trap, or the greenstone and hornblende rocks in the vicinity

Along with the menachanite, and among the sand in which the gold was found, occur comminuted fragments of fibrous malachite; one (No. 3) a little larger than the rest, contained an irregularly shaped fragment of native copper; which, from its dark rough surface, I thought at first was hematite, but, in endeavouring to break it with a smart blow of the hammer, I completely flattened it. A few small scattered grains of a greyish white metal occur, but are very rare: one of these has a slightly yellowish tinge, resembling the argentiferous gold, or rather auriferous silver, of Norway. The largest of these metallic substances (No. 4), a flattened water-worn button about half the size of a pea, having a purplish black enduit, on being submitted to re-agents, proved to be almost entirely composed of silver. I should have been inclined to suppose this fragment, from the scarcity of this metal in the rocks of India, to have been adventitious; had not I discovered a grey silver ore (No. 5), in a fragment of quartz shortly afterwards. It is by no means improbable that some of the smaller, flattish, grey, metallic looking grains may prove to be platinum, a metal which is often associated with gold.

The pebbles and sand, composing the bed of the rivulet, are derived from the Kupputgode hills, which form the sides of the valley through which the stream runs, and among which it has its rise, and are mingled with both fragments of kunkar and hematitic iron ore. The sand is composed chiefly of particles of quartz, variously coloured, comminuted garnet, and the metallic sands first mentioned. The surrounding formation is gneiss, with its associated schist of mica, hornblende, and greenstone, chloritic and clay slates; passing, in their upper portions, into silicious and ferrugenous schist, with beds of a lateritic rock. Near the base, between Guddak and Dummul, I found thin veins of a white, sub-crystalline marble in the greenstone slate. The whole of these rocks are penetrated by, and appear to owe their elevation to, large dykes of basaltic trap. Granite, too, is seen at no great distance in the plain to the south of the chain.

In tracing the gold dust to its matrix it will be useful to recollect that where these plutonic rocks come in contact with the primary schists, a greater tendency to metallic and silicious developement is almost invariably observed, and it is in veins of quartz, ferrugenous quartz, and their alluvium, that we find gold to exist in the greatest abundance, from the Himálayas to Cape Comorin, in the Malayan peninsula, Borneo, Sumatra, Assam, the Birman empire, Hungary, and both Americas. On the peninsula of India, I have only heard of one exception to this rule, which is said to occur in the Madura district; where, according to Sir Whitelaw Ainslie (Mat. Med. vol. i. p. 514), gold was discovered by the late Mr. Mainwaring, mineralized by means of zinc, constituting a blende which, he thought, resembled somewhat the Schemnitz blende of Hungary. The gold washings, and mines of Mysore, near the Baterine hills, discovered by Captain Warren, those around the base of the Neilgherri and Koondah mountains, in Wynaad and other districts of Malabar, all exist in primary formations, and associated with silica and iron, either in an integral state, or in the form of alluvial beds, clay, or sands. The richest gold mines of the eastern islands, as I have before stated, are found in similar geognostic situations, along the edges of the great volcanic belt that passes through the Indian Archipelago—a fact deserving of notice.

I was informed by the natives of Doni, that gold is found in greater abundance in the bed of the rivulet of Sottoor, a few miles from Doni, in the same range of hills, and I discovered it previous to my visit to Doni, in the sands of the Hurti rivulet, in the same range a few miles to the south of Guddak. The sands of both these rivulets are washed for the gold by the *jalgars*. It exists likewise, I was told by an old Hindu inhabitant of Savanur, in the Kor taluk of the Darwar collectorate, near Chick Mulgoond. In 1837, while passing through the western part of Mysore, I found a few grains of it, in the bed of a rivulet, near Gram, at the base of the Belladaira hill. These auriferous rivulets should be traced to their sources, which cannot be far distant, the sand carefully examined at every 40 or 50 yards, and the spot, where the particles of gold no longer appear, most diligently explored, the subjacent rock laid bare, and, if necessary, an excavation made into it.

I hardly need remark that the natives are perfectly acquainted with the art of purifying the gold dust by amalgamation, and that of refining it by means of repeated exposure to heat *below fusion*, with a mixture of muriate of soda and cow-dung ashes, the last of which is sometimes replaced by the powder of an *old* brick, mixed with a little borax. In simply melting gold, borax is added to assist its fusion. In the native process of amalgamation, a considerable loss is sustained from ignorance of the method for condensing and collecting the mercury, which is suffered to escape by volatilization. The existence of gold and manganese, in the Kupputgode hills, appears to have escaped the notice of that excellent observer Christie, and also of Marshall, and Colonel Sykes, the statistical reporter of this part of the Deccan.

Manganese Mines near Wodoorti, Kupputgode range.—At the time of my visiting the Kupputgode range, I had not seen Dr. Wilson's remarks on the minerals sent to the Museum at Bombay, by Trimulrow; from whose oral account, and from what he had heard among the hills, I was led to imagine the possible existence of coal among them; and, indeed, on my arrival, most of the natives concurred in assuring me that, there was a black stone to be found near Wodoorti, called charcoal stone (*kolsah ka putther*), which Hyder and Tippoo had made especial search for. Led by this hope, though the nature of the formation over which I had already passed excited strong suspicions against the truth of the report, I crossed the hills by a steep and rugged path to Wodoorti, a village in a jungly valley, on the opposite side. About two or three miles hence, in a sort of defile that intersects the course of the chain on the north of the valley, at nearly right angles, I was conducted to a few half choked up excavations, at the bases of some large detached masses of a dark coloured rock, externally ferruginous and rugged; internally of a bluish black hue, tough and powdery under the hammer; and some parts, when struck, emitting a sulphurous odour. It contains numerous veins and nests of a shining foliated mineral of an iron grey colour (No. 5). Some of the cavities contained a white felspathic powder, others were coated with small stalactitic and botryoidal incrustations of the black mineral. Before the blow-pipe, per se, it fuses partially at the edges, with slight gaseous extrication, leaving a shining bluish black slag. In the yellow or oxidizing flame, it gives out a slight sulphurous odour, and the slag is affected by the magnet. With borax, on charcoal, it fuses with slight ebullition into an amethystine glass; and, with carbonate of soda on platina foil, into a light bluish green glass. When powdered, and treated with muriatic acid, the extrication of the peculiar fumes of chlorine sufficiently attest the presence of manganese. I was unable to detect the existence of plumbago by exposure to a deflagrating heat with nitrate of potash. Hence the mineral would appear to be the black oxide of manganese in combination with iron, and probably a little sulphur and alumina.

Sir Whitelaw Ainslie (Mat. Med. vol. i. p. 538), states that this metal,—so useful in the arts in Europe, in the composition of the finest kinds of crystal and flint glass, and common bottle glass; imparting a beautiful amethystine or red hue to glass, in yielding the rich brown tint used for painting porcelain, in bleaching, and in the preparation of chlorine gas,—is not common in India. He mentions that Captain Arthur found it in Mysore. Since his time however, it has been discovered by Colonel Cullen and Dr. Benza on the Neilgherries, by Major Burney in Ava,—and occurs associated with iron on the Himálayas. I have found it, also, in combination with oxide of iron, in veins in the laterite composing the cliffs at Bedar, in the Nizam's territories, near the line of contact with the trap on which the laterite there rests; in the sandstone of the Southern Mahratta Country, between Kulladghee and the falls of the Gutpurba near Gokauk; and in the primary schists of Sondur, and the copper mountain range, in the Ceded Districts. The formation of the Kupputgode range, near the manganese excavations of Wodoorti, is similar to that of Doni, previously described.

Flint pits.—About two miles southerly from the manganese locality, some excavations were pointed out to me in the plain, near the base of the opposite range, whence Hyder and Tippo used to supply their troops in this part of the country with flints. They are of a yellowish brown colour, translucent at the edges, tough, of a jaspery nature, and answer the purpose, it is said, extremely well. There is still an abundant supply.

The Corundum mines near Gram in Mysore.—The Corundum mines of Golhushully and Kulkairi, lie about seven or eight miles east by north from the fort of Gram. They occur in a bed of talcose slate, associated with mica slate, gneiss, and protogine; and consist of a series of excavations dug in the plain, varying from two to twelve feet in depth. The corundum is generally found in a gangue composed of white and greenish earth, arising from the decomposition of the adjacent rocks, and associated with ferruginous quartz, a poor brown iron ore, ferruginous earth, chert, a reddish jasper, schorl and felspar. In one of the excavations, I found a fragment of rock salt, and many of the wells in the vicinity are brackish. The corundum often occurs in amorphous fragments, from the size of a pin's head to that of a turkey's egg. It is not unfrequently seen in hexagonal prisms, tapering slightly to one end. The colour varies from whitish to grey, reddish, and hair-brown. The pieces of corundum are thrown out, cleared and separated by the miners into four classes, viz. the reddish brown, the white, the chips of both, and the refuse. The three first form the articles of commerce; which, according to my native informants, are sent down the ghauts to the ports of Mangalore and Tellicherry; and there sold by the contractors to the Bombay and Arab merchants, at prices from 12 and 15 to 30 rupees the candy, according to quality. The natives on the spot, in 1837, told me that the mines had not been opened until within the last 8 years, and that the corundum is also found at Burkunhully, Kundeo, and Yedgunkul, in the Chinraipatam division: at Norhik in that of Narsipur, at Deysani Curbonhully, in that of Bannawar, at Appianhully, Beygoor, Bunnercota, Mundium and Permuty in Mysore; near Gusehutty and Chennimully in Coimbatore, near the Tapoor ghaut, in Salem, and also in Cuttack.

Diamond Mines of Ramulacota in Kurnool.—These mines are situated in the Kurnool territory, about 21 miles south of the city of Kurnool, in the lower part of a large basin-shaped plain, almost surrounded by low hills of sandstone, grit, breccia and puddingstone, associated with the limestone of Cuddapah. The present excavations occupy but a circumscribed area, of about 1,000 square yards, and are dug in the alluvial soil at the base of the hills. Remains of old and extensive mines appear in a low adjacent ridge, composed of a dark ferruginous grit and conglomerate, and the rock has all the appearance of having been blasted by gunpowder. Diamonds of a very fine quality are said to exist in this conglomerate, but as they are few, and the labour of excavating and blasting the rock great and uncertain, the rock has been quitted for the alluvial soil; where, though the diamonds are of an inferior quality, they are more numerous, and attained with greater facility; and, with the most common tools, by ordinary native labourers.

The diamond pits, though not occupying so large a space of ground are deeper and far more extensive than the celebrated mines in the vicinity of Cuddapah, at Chinnoor, Avalumpully and Condahpetta. The excavations in the rock resemble those at Banaganpully, and at Muni Mudgoo, north of Gooty. The geognostic position, the alluvial stratum of water-worn pebbles and sand, in which the majority of the gems occur,—the chert, quartz, and jasper pebbles composing the puddingstone and breccia, cemented by a dark ferruginous sandstone, —the vicinity of granite and dykes of basaltic greenstone, present the conditions under which I have usually seen this gem appear in the peninsula. Kunkar is seen, but sparingly. The diamonds which I saw at Ramulacota, were of an inferior size, and but few crystallized in the octohedral form. They had severally the white, grey, yellow and greenish tints; but it is said those that occur in the conglomerate, and in a spot close to this rock, are generally of a superior description, with a fine roseate tinge. The process of mining and washing, resembles what I have before described, in speaking of the Cuddapah mines. There were about 20 natives engaged in washing the alluvium when I visited the spot, and while I was looking on a small fragment of diamond was discovered, which was regarded as a propitious omen. In the dry season, 500 labourers are usually at work, who pay generally a certain sum to the contractors. The latter I was informed, rented the whole of the mines from the Nabob of Kurnool, for about 750 rupees per annum. The usual hire of a labourer on the spot is, I believe, 4 pice and a meal of rice per diem. The opening of a new mine in the dry season presents an animated scene, and was sometimes honoured by the presence of the Kurnool Nabobs.

Diamond mines formerly were worked in the Kurnool territory, at Saitancota, Deonoor, and Tandrapaud. They are cut and polished by the jewellers of Muni Mudgoo, who have been long famous for their skill in polishing diamonds, and were formerly sent for sale to the metropolis of Golconda, and subsequent to its fall, to that of Hydrabad.

I have the pleasure to present to the Society a model of a diamond polishing machine, used at Muni Mudgoo, and constructed for me there by one of the polishers. The use of diamond dust in the process of polishing is thoroughly understood by the natives, and in splitting the larger gems they take advantage of the planes of cleavage.

Examination of the specimens of Minerals alluded to in the foregoing paper.—By Lieutenant J. BRADDOCK.

No. 1.—*Gold dust, found in black magnetic sand.*—The grains of gold, though few, being large enough to form a judgment on, need not to have been tested; but, on testing them, after solution in nitro-muriatic acid, no doubt existed of their being gold.

No. 2. *Menachanite ?*—Feebly magnetic; in small grains, somewhat like coarse gunpowder. External appearance agrees to the description given of menachanite in Ure's Chemical Dictionary. It was examined as follows.

Blow-pipe.—With borax on charcoal, fused into a green glass. Fused with pure potash on platina foil, and treated with muriatic acid at a boiling heat, the powdered substance was partly soluble, leaving a dark brown residue. The muriatic solution was milky yellow, which, when tested, gave the following indications :—

Tincture of galls—Reddish brown colour.

Oxalic acid—No immediate effect: next day a small whitish precipitate.

Ammonia—Copious dirty brown precipitate: next day clear reddish brown solution, with darker precipitate.

Hydrosulphuret of Ammonia—An immediate deep greenish black, changing almost instantly on the surface to white, and passing afterwards into a dirty yellowish brown, which was ultimately precipitated.

On selecting by means of the magnet, a few grains more magnetic than the others, prussiate of potash, and tincture of galls, indicated the presence of iron. Two small grains, picked out from the other grains, proved to be silver. The mineral may possibly be menachanite, and may contain titanic acid, but the quantity was too small to be subjected to a sufficient examination.

3. *Malachite* ?—(and a button of metallic copper).

The proper tests gave distinctive indications, that copper was present in this mineral.

4. *Silver* ?—This specimen was a button or large globule; it had a blackish purple tarnish; had been flattened by the hammer. On trying its further ductility, it flattened under the hammer, and crumbled at the edges; the crumbled portion had a granular appearance; globule cuts like silver: white; on beating in the diamond mortar, it flattened and was malleable.

The usual tests left no doubt of its being silver: it dissolved in nitric acid, and left only a little black powder as a residue.

5. *Grey silver ore* ?—Crushes easily; frangible; powder not at all the colour of the ore, but dark red lilac. The external characters of the ore approach near to the description in Ure's Dictionary, of the grey carbonate of silver and bismuthic silver. As the specimen was small, a piece about the size of a pea was examined, and gave the following indications:—

Reduced to powder and treated with nitric acid; slight disengagement of nitrous gas: large portion undissolved.

A.—This acid solution gave on testing the proper indications of silver.

A.—This residue was treated with muriatic acid and heat: a part was insoluble, B.—The muriatic solution was tested and gave the following indications of antimony:—

Water—The solution turned milky.

Zinc—Black precipitate.

Hydrosulphuret of ammonia—An orange coloured precipitate.

B.—On this residue, muriatic acid and heat appeared to have no further action. Nitric acid was then added, and the mixture boiled. There was still an insoluble portion left. C.—This nitro-muriatic solution was examined as follows:—

Water—Produced opalescence (antimony).

Prussiate potash—Emerald green, changing to blue when precipitated.

Ammonia—White flocculent precipitate.

Hydrosulphurate of ammonia—Greenish, changing yellowish brown.

Tincture galls—No effect : next day settled into a flocculent brownish yellow precipitate.

Phosphate soda—Slight white flocculent precipitate.

Sulphate of iron—Slight dust-like precipitate.

Oxalic acid—*Muriate of tin*—no effect.

The precipitate C contained sulphur, which was burned off, leaving a black residuum, which by deflagrating with saltpetre, indicated the presence of carbon in some shape. The residuum after deflagration was washed, and 2 or 3 minute globules of silver collected ; also another minute metallic globule, and a little silex, and earthy matter.

The small metallic globule was so minute that it required to be examined by the microscope, and admitted only of two tests being applied to it. The examination resulted as follows. Colour, dark iron grey ; lustre, dull, metallic ; streak, a lighter grey of dull lustre ; malleable ; harder than silver ; insoluble in nitric, but soluble in nitro-muriatic acid :—this solution was tested with,

Hydrosulphuret of ammonia—Which gave a dark green colour, which turned into a black precipitate, leaving the solution tinged olive.

Prussiate of potash,—gave an emerald green colour.

I may here state that two minute metallic grains were picked out of the menachanite, No. 2, which proved as before stated to be silver ; and a third grain soluble only in nitro-muriatic acid, which being tested as for platina, and compared with a solution of platina foil, gave indications as follows :—

	Metallic grain.	*Platina foil.*
Muriate of ammonia	no change	no change.
Old muriate of tin	dark brown passing to lilac.	yellowish brown.
Fresh made do.	lilac	lilac.
Prussiate potash	bluish green	lighter bluish green.

Tincture galls..............lightish brown...... .... darkish brown.

Query, whether the solution B, and the single globule from C, together with the last mentioned single grain picked out of No. 2, may be considered as indicative of platina ? The silver ore No. 5 may perhaps contain the following substances.—It was picked up in the same locality as No. 2, of the specimens mentioned in the foregoing paper.

Silver.
Antimony.
Sulphur.
Carbon, or some carburet.
Platina ? doubtful.
Silex.
Earthy matter.

No. 6. *Manganese* ?—slightly magnetic.

Blow-pipe—with borax, amethystine glass. Dissolved in muriatic acid with heat, evolving chlorine. The solution behaved as follows.

Prussiate Potash—Green grey precipitate.
Ammonia—Brown precipitate.
Carbonate Potash—do.

The powder was tried with nitre, but no deflagration occurred.

The specimens most interesting in the examination were the grey silver ore, and the small metallic grains; but all the specimens were so minute in quantity that only a first rate analyst could pronounce decidedly concerning the more difficult points. It would be desirable that the bed of the nullah and the hills immediately adjoining should be inspected more minutely: it might repay the mineralogist, if not in pocket, perhaps in the honour of new discoveries.—Captain Newbold was kind enough to assist me in these examinations.

IV.—*Journey of the Russian Mission from Orenbourg to Bokhara.—Translated by Colonel* MONTEITH, K. L. S., *Chief Engineer of the Madras Army.*

(*Continued from vol.* 10 *p.* 168.)

BOOK SECOND.

CHAPTER I.

Observations on the Khanats in the vicinity of Bokhara—the ruling race in Central Asia.

The Asiatic people to whom the Russians give the name of Tartars, have the nose slightly flattened, the cheek bones prominent, little beard on the chin, and small eyes, frequently with a cast in them. Gengis Khan, at the head of the Mongols, subjugated the Tartars, who became incorporated with his army, and those of his successors. As they were the most numerous, the conquerors adopted the Turkish language, barbarous as it was; from this mixture of Tartars and a race similar to the Mongols, sprang, I think, all those tribes regarded as Mongol Tartars: they ought to bear this name, which is appropriate to them, and which prevails in Turkistan.

What difference is there in fact between the features of a Kirghiz, an Ouzbek, a Turkoman, a Kezareh, an Eimah, and those of a Turk of Constantinople, or a Tartar of Kazan or Crimea.*

Some modern geographers affirm, with but little foundation, I think that the Kirghiz possess the features of pure Tartars, which resemble those of Europeans; but it is impossible to confound the Kirghiz, and the other Mongol Tartars, with the Kalmoucks, since they do not possess the same corpulent frame, or features so strongly marked.

The Kalmoucks speak a different language, and have the Tartar features to the most exaggerated degree.

A part of the Kalmoucks who fled from the banks of the Volga, in 1770, were obliged to remain, or were captured by the Kirghiz; this has tended in some way to increase the strongly marked Tartar features, which are still met with among the Kirghiz.

Having on the road asked a man, who possessed completely the Mongol feature, if he was a Kalmak (that is what is called a Kalmouk), his companion began to smile. On enquiring what there was in the question to excite their mirth, I learned that the Torgout Kalmouk, having been reduced to a state of slavery among the Kirghiz, it was considered as a disgrace to have descended from them. I then understood what it was that had caused a smile at the expense of the Kirghiz, whom I had so unintentionally offended.

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* The author must speak of the Turkoman tribes in Asia Minor, for the Turks of Europe, by constant mixture with Europeans, have decidedly Greek features, full beards, and generally a fairer complexion than the people of the South of Europe.—*Translator.*

The boundary which is generally assigned to Tartary, does not appear to me correct: for, under this name, the country inhabited by the Tartars of Siberia, Kazan, Astracan, Crimea, and that which extends from the Belour mountains to the Caspian Sea; for the Turks of Constantinople ought to be included in the same race: in Dzoungarie in the little Kouldja, five hundred dwellings belong to the Doungani Tartars, who are the same race with those who occupy one thousand dwellings in the great Kouldja, and who all speak the Tartar and Mongol languages.

The Tartars, who dwell and reign in the country, erroneously called by us little Bokhara (a name unknown to any Asiatic, and for which I will henceforth substitute that of Chinese Turkistan), although subjugated by the Kalmouks, have nevertheless not become entirely extinct; they are, however, more of the Dzoungar Kalmouk, who passed into Chinese Turkistan, along with the Mandchous in 1759. Tartar is still the prevailing tongue in Cachghar, Jarkend, Khoten and Ak sou. These then are the countries which belong to Tartary in a literal sense.[*]

I do not coincide in the opinion of those who maintain that geographically, Tartary should be regarded as extending eastward, as far as the Belour mountains, and to the south-east as far as Hindoo Koosh, which there separates it from Afghanistan.

In this case, the race of Tartars, who never extended so far southward, would at the same time comprehend, under the denomination of Tartary, some countries which are not of Tartar origin, while it would exclude Chinese Turkistan, which is literally so. If in geography we give to a country the name of a people, it should be conditional on such people inhabiting that country.

It appears to me then, that Central Asia would be a more appropriate name to introduce in lieu of Tartary, since I have found it more correct, and more geographical.[†]

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[*] I have seen many of these people who speak Tartar and not Mongol.—*Translator*.

[†] It is almost impossible to translate this chapter, which is obscure even in French, and is generally the case with the Count's style of writing, it not being his native tongue.—*Translator*.

CHAPTER II.

Central Asia—Division—Appearance—Mountains—Rivers and Streams—Sea of Aral—Marshes—Climate.

I consider Central Asia to be the country bounded by the Irtich, the Altai, the Tarbaghatai, the Moussart or Mous-tagh (ice mountains), the Belour (christal), the Hindoo Koosh, mountains of Ghaour, which bound the north of Persia, the eastern shore of the Caspian Sea, the Oural, and the northern boundary of the steppe of the Kirghis.

Independent Tartary is applied to those states, which are still unsubjected; in which sense, they belong to political geography, but to preserve consistency in any description, I will adopt the name of Independent Mongol-Tartary.

The great table land, inhabited by the Mongols, may be called Mongolia, and to avoid confusion, I will adopt the names of great and little Tibet, Chinese Turkistan and Dzoungarie, or province of Ily, as the Chinese call it.

The regions of Asia, which I have either visited, or obtained certain information regarding, are, to the north, the countries of the Kirghiz; to the west, the Khanat of Khiva, the Cara-calpaks, the Aralians, or inhabitants of the banks of the Aral lake, and Turkomans; to the east, the Khanat of Khokhan (called Ferghana by the Arab authors), including the towns of Tachkend and Turkistan; to the south, Bokhara, the desert inhabited by Turkomans, the Khanats of Meimeneh, Ankoi Balk, Khoulm, Badakshan, Koulab, Hissar, Cherzabés (green city), the country inhabited by the Gillijes Afghans, or eastern Persians, the Kezareh, the nomade Chiites, Chgaanies, the Dervazeh Pagan nomades.

The elevation of the steppe of the Kirghiz is very low, by our observations, the barometer, during a constantly calm atmosphere, stood at 27 inches, seven and eight lines, the thermometer being at about 8 or 10 degrees of Remeur. The steppe, about the 52 degrees north latitude, as a fertile soil, producing forests of pines, birch, and good grass. To the south, the country is deficient in moisture, a few fir trees here and there met with in some spots of the Olou-tagh, a chain of mountains, which, generally speaking, only present valleys, devoid of vegetation, granite rocks, and mines of lead.

In the western parts of the deserts, that is to say, the route from Bokhara to Orenbourg, grass is only found near the mountains of Moughodjar. Beyond the Orsk it is not met with to within 250 verstes of the Oural. Not a bush is met with in this space, so that caravans are obliged to carry fuel to cook or warm themselves. It is impossible to make use of cow-dung except in dry weather.

The greater part of the Kirghis steppe, is composed of argillaceous plains, slightly undulating and covered with worm-wood, a few thorny plants, and on approaching the south, the bush called saksaoul.

This dreary waste includes some extensive sandy deserts, the largest of which is the Cara-coum, bounded on the south by the Sir-deria, and the Bitipak which extends to the north and N. E. of Turkistan: having before described these deserts, it is unnecessary again to mention them; cultivated spots are to be met with, on the banks of the Sir-deria, and between the river Kouwan and the Djan-deria; they are also found near all the towns, for instance, near Turkistan, Tackhend, and others.

The country between the Sir and the Amou-deria, is occupied by the Kizil-coum, the soil on the northern and southern extremities is clay, with less admixture of sand than the steppe of the Khirghiz, but more arid, and consequently more barren.

Between the Caspian and the Sea of Aral, the soil is generally sandy, water is here procured from wells, said to be from six to nine toises, or fifty-four feet deep. A rocky chain of mountains called Kharaghoumbet, runs along the Sea of Aral, and from the banks of the Bay of Bourzouk, or Koul-Madjar, to the nearest point of the shores of the Caspian, the ground is covered with shells, apparently indicating an ancient junction of those seas.

The cultivated spots near the towns, or on the banks of rivers, are merely small patches, rendered fertile by means of irrigation, the greatest part of this region is a desert, inhabited solely by a small number of the wandering tribes.

The vast plains of Central Asia, are intersected by chains of mountains. In the midst of the steppe of the Kirghiz the group of Oloutagh rises above all the mountains of the desert; it terminates the Arghamat chain, running from east to west. Two ranges branching off from the Oural mountains, runs into the steppe, the one near Gouberlinsk, of which we have already spoken, the other near Akto-caraghai, passes to the north of Verko-ouralsk; this branch retains its name as far as the source of the Tousak; then it is greatly diminished in height, and takes the name of Dajabouk-caraghai, after which it again attains a great elevation near the source of the Soundouk, it again sinks, takes the name of Karaadir-tagh, and joins one of the branches of the Moughodjar mountains.

The Karaadir-tagh mountains, extend to the east, as far as the Tou palak-tagh, a branch terminated by the heights of Teke-tourmas an Kotour-tagh, near the Sari-tourghai. It is worthy of remark that no a single salt lake is to be met with in the western side of the Atko caraghai, though there are several immediately on the east of thi chain.

The Boukhan hills, to the south of the Kizil-coum, extend to th west, as far as the Amou-deria, near Khiva; they then form the chai of Vassil-cara, and are well known by that name, and perhaps close to th Amou-deria, they are the origin of the Djani-chir, or Liou's hear a name which is found in Hadji Khalfa's Turkish geography, thoug actually unknown in Bokhara.

On the eastern side the Boukhan hills unite with the Koukert li, and apparently only a branch of the Alps, situated to the nort of Samercand, as well as the whole mountainous country of Bukbouldoul Sousiz-cara, Koultchouk, and Arslan-tagh, is a branch, which detache itself from the Alpine country, lying to the north-east of Samercand and probably between it and Djisagh. The southern ramification of thi branch is terminated by the Noura-tagh (mountain of light), which i very high, we had a view of its summit from Caraghata, which in th month of December, was covered with snow, of which there was non on the plain. It will be hereafter shewn, that this mountain favourabl affects the cultivation of the lands, between it and Bokhara.

The south-eastern extremity of this table land, is the most elevate and from the space between Khokhan, Nissar and Dervazeh, spring tho mountains covered with eternal snows, of which I was unable to lear the names from any native of Bokhara; the highest of these chains lie to the north of Dervazeh, the next in height are those to the north Khokhan, which in the first instance, extends along the road, leading Kachghar, cross it near mount Terek, which is also almost constantl covered with snow, and then spread to the left of the road. Monsie Nasarov, who was obliged to halt at Khokhan, and at Margakhaneh, i the year 1819, and who has since given an account of his journey, call these mountains Kachghar-divani; they are joined by the Terek to th Ala-tagh, where the Sir-deria has its source. The Ala-tagh extend from Turkistan, Tachkhend and Khokhan, to the frontiers of Dzou garie, all the mountainous country is inhabited by tribes of Kirghis the great horde, called the black or savage. These mountains are cal ed Ala-tagh, which means pie-bald form, some of the summits being constantly covered with snow, whilst others are brown and free from it.[*]

There is a very high mountain situated to the north of Ramit, a city to the east of Bokhara. This mountain joins the chain extending to the north of Iagnaou, and unites to those of Bokhara; then separating into a number of ramifications, the general direction of which I have attempted to lay down on the map, between Samercand and Chersabés (green city), there is a very elevated chain, which gradually diminish as they divide before reaching Carchi. In following the road to Ghoussar by Deïnaou, to Hissar, there is on the north side a very elevated chain of mountains, which become lower on approaching the Amou-deria. Hereafter I will describe the route followed by the caravans from Balkh to Caboul, a route, which if accurately kept, would throw much light on the topography of these countries. The two great rivers the Amou and Sir, water the countries through which we passed. The Amou only takes this name after the junction of the Zour-ab or Wahch, with the Badakhchan, two considerable streams, one coming from the north-east, the other south-east the Amou. These receive the Kafer-nihan (name of the infidels), the Toupalak; the Ghouloum majestically flows in a bed of from 200 to 300 toises broad, it then divides into two branches, and falls into the lake of Aral, after a course of nearly 1,400 verstes, or nearly 1000 miles. I do not imagine that the Mouhrab can reach the Amou, and it appears to be lost in the sandy desert through which it flows. It is certain that the river of Samercand called Kouwan, and also Zer-afchan, is lost in the Cara-koul lake, which has no apparent communication with the Amou-deria (Oxus), and is distant from it nearly 30 verstes.

Much discussion has taken place regarding the ancient mouth of the Oxus. Some geographers have supposed that the travellers of the 16th and 17th century, have less expressed what they have seen with their own eyes, than what they have endeavoured to reconcile with the frequently false geographical statements of Ptolemy, and even deny that the Oxus ever flowed into the Caspian, though Jenkinson, Bruce, Hanway, Beckevitch, all state that a branch of this river actually falls into the Caspian. It appears to me there is some credit due to these travellers, particularly as Monsieur Mouraviev,[†] a colonel in the Russian service, who went from the Balkan bay to Khiva in the year 1820, himself saw traces of the branch, mentioned by the before mentioned travellers. M. Mou thinks the Amou, about 160 verstes north of Khiva, turned to the and divided into two branches before entering the bay of B However it is not Monsieur Mouraviev alone who has assured his having seen the ancient bed of the Oxus in many places be the Caspian and Khiva, in which bushes now grow: a Major of Cc and native of Khiva, who was a very well educated man, conside would be easy to restore the ancient course to the Amou-deria, he supposed was too notorious to be doubted. It is currently reporte this river was turned by the Khivians during the piracies,* of the C Stenko-Razin, in 1670; but Jenkinson says in 1559. The Oxus fo ly fell into the Balkan bay, but now does not reach so far, but into the lake of Kitai, or Aral; all the water in this country is p ed by canals from the Oxus, which is the reason it no longer re the sea.

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[*] I think this is a mistake, Ala-tagh is literally high mountains, and a very just name for them, they divide China from Tartary.—*Translator.*

[†] I have generally seen his name spelt *Mouravieff*, now a general, and lately employed on a diplomatic mission to Constantinople.—*Translator.*

The general opinion at Khiva is that an earthquake, about 500 ago, changed the course of the Amou-deria. This assertion has no impossible in it, as the countries of Khiva and Bokhara are very s to these natural convulsions: it is therefore quite possible that the formerly divided into two branches north of Khiva, one falling the Caspian, and the other into the Aral: this, if correct, will rec the conflicting opinions of geographers on this subject.

The upper Amou-deria, or Zour-ab, near Dervazeh, is abo toises broad, and exceedingly rapid, till its junction with the Karate Gold dust is found in the sand; the banks are very high and precip and the bed obstructed with rocks, over which the stream foams great noise and force. We will leave to Mr. Elphinstone the ta describing its source, as I heard nothing regarding it, which coul depended on.

The Sir-deria which has a course of about 1200 verstes or 800 mil ly becomes considerable after its junction with the Akboura, which near to Tadj or Takht Suleiman, a mountain also called Och. He valley enlarges, and the stream becomes more rapid. Its source is hid in the mountains of Belour and Ala-tagh. None of the travellers who annually go from Khokhan to Kachghar, could give me the least information on the subject. Many streams fall into the Sir between Khokhan and Kodjend; near the last city it is larger than at its mouth, in the Aral; the sandy deserts through which it flows absorbing a great quantity of its waters. About 350 verstes from its mouth the Kouwan separates from it; this last then divides into five channels, which again unite, and form a number of lakes called Aralu-koullar, near which the country is fertile and well cultivated. Before the Sir enters the lake of Aral, it again unites with what remains of the Kouwan. Higher up it also receives a small stream from it, when the river is full at the melting of the snow. This branch certainly offers facilities for irrigation. The people who reside on the river assured me both the Amou and Sir are fordable at several points; but I have never seen any person who had actually crossed in this way.

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* This river is expressly stated to have been turned by the Khivians, about t of the Russian expidition under Prince Bekevitch, in the reign of Peter the Grea troops were massacred or made slaves by the Usbecks; from which time, the R have constantly had in view the conquest or punishment of this state. I fully c with those who assert that the Oxus once fell into the Caspian; at least its p branch. An intimate friend of mine, Budeh Beg, who was in the service of Pe subsequently entered that of the Khan of Khiva, considered it a point beyond d and asserted that, in high freshes, a part still look that direction. Should Russia permanently that position, Khiva, I believe there will be no doubt of the Oxus again restored to its ancient bed, which will throw the whole of Tartary open enterprize of hers, either warlike or mercantile.—*Translator.*

They have recourse to different methods for crossing these rivers. I passed the Sir in a row boat; M. Nasarov crossed it near Khokhan in a boat drawn by horses, swiming across. Another and rather a singular method was told me; the traveller's clothes are put into two leather bags,* which are afterwards filled with air, and on which he takes his seat; they are then tied to the tail of a horse, which swims across the river; the traveller being bouyed up by the inflated bags. From what I was told in Bokhara, I am inclined to think the Amou-deria is passed in the same manner. I was assured that people who cannot swim lie down on one of these inflated bags, and paddle themselves along, with one hand without any danger; as for the Kirghis their skill in swimming is of little use to them, as they always hold fast their horse's mane with the right hand, swim with the left, and thus cross from one bank to the other of the Sir.

The Irghiz and the Tourghai, the junction of which I witnessed in the Tonghouz-khan, are inconsiderable rivers; in many places they are almost dry. They form the lakes of Aksakal, extending to the north-east, and the most westerly of which is separated from the sea of Aral by chains of clayey hills, in the midst of sandy deserts, making it very unlikely any subterranean communication should exist between them: the distance is 130 verstes. The names of Taraz and of the Talaz are at present unknown.

The sea of Aral, called by the eastern nations Ourghentch, is surrounded on the east and north-west by sandy hillocks and clayey plains; on the north-east the banks are twenty or thirty toises above the water; on the north-west are the bay and lakes of Koulmaghour. Near them are to be seen the remains of an ancient fortress, a well of fresh water, and the traces of the ancient bed of the sea, extending a considerable distance on this side. On the west of the Aral is the chain of Karaghoumbet hills, very steep on the side next the sea, but with a gentle slope on the other side, and giving vent to numerous small streams. The easiest route by which Russian troops could reach Khiva would be along the foot of these hills, at the distance of 5, 10 or 15 verstes from the sea of Aral. The road then passes near the Aksouat, and the Khodjabeg, two lakes about 40 verstes from each other. The latter is about 100 verstes from Khiva. It is only after reaching this lake that the water of the sea of Aral becomes fit to drink; the water here changes colour, becoming whitish by their mingling with the Amou. The southern part of the sea of Aral is full of islands, inhabited by Aralians, a people subsisting entirely on fish, and tolerably expert in the management of their vessels. They make use of sails; the Kirghiz, on the contrary, content themselves with coasting along in row boats as far as Khiva. I was assured they never used sails; being in that respect different from the Kirghiz at the mouth of the Emba, who have lately begun to make the journey by water. The Aralians are the only people who fish in the sea of Aral; the Kirghiz confine their fishing to the Sir. The same kinds of fish are probably found in the sea of Aral and in the Caspian. We saw at Bokhara a small kind of sturgeon, found in the former sea; it was 3 or 4 feet long. I imagine the western part of the sea of Aral is the deepest, as its banks are mountainous.

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* This is common on the Tigris and Euphrates also.—*Translator.*

There are no marshes in the steppe. The Sir forms lakes from overflowing its banks at about 50 verstes from its mouth; some of them are dried up by the heat of the sun, and 10 verstes from either side of the river are plains covered with reeds. They resemble marshes, in spots where the inequalities of the soil have permitted the water to lodge every where; else the water filters through the road, without ever becoming stagnant. There are, however, places in the steppes where the soil is clayey, impregnated with salt, and where a person sinks in crossing, though no water is perceptible.

The climate of the Kirghiz country is very healthy; almost all strangers who reside some time have a disposition to grow fat; the air is very pure and light; in passing through we felt frequently the greatest pleasure from its fresh invigorating quality. Consumption or other diseases of the chest are seldom felt, and the small pox is unknown. The Kirghiz, however, who come to Russia, are particularly subject to take the infection; as likewise in Bokhara, where it sometimes exists. The Kirghis have a great dread of this disease and with reason, as they generally take it at an advanced age, when it becomes most dangerous.

It is a great mistake to suppose the steppes of the Kirghis enjoy a cool or temperate climate. The heat is excessive, and the clay plains, or burning sandy deserts, retain a long time the heat, more so from the total absence of shade or vegetation.

In the commencement of May, the heat had already become almost unbearable. We moved with difficulty; all animals had sought what shelter they could find, and there reigned a dead silence. Dew is seldom known at this season, and towards the end of April the grass is already burnt up. In the month of June 1821, the thermometer at Orenbourgh rose 49° (Reaum) in the sun, and was 27° at 10 P. M. In the winter it often fell to 30°. The Kirghiz during the summer go almost naked; wrapping the skin cloak round the middle, leaving the back and upper part of the body exposed during the time they are at work.

To these burning summers succeed very severe cold in winter, but are more temperate to the south of the Moughodjar mountains and deserts of the Cara-coum.

CHAPTER III.

Khanat of Khiva—Route from Saratchik to Khiva—Khanat of Khokhan—Wild Kirghiz—Mountains of Ala-tagh.

It is not necessary to dilate much on the Khanat of Khiva,* M. Moraviev, who visited it in 1820, having published a detailed account of his journey. A daughter of Abulfaiz of Bokhara, contemporary of Nadir Shah, married the Khan of Khiva, named Kaip, of a Kirghiz family, from whom is descended Mohammed-Rahim, now governor, who is as enterprising as fortunate. He has succeeded in bringing under subjection many of the Turkoman tribes, situated to the south-east and west of his dominions. His power at present extends from the shores of the Caspian to the boundaries of Bokhara; the city of Khezarist or Hizarasp is his southern possession, and the tribes under him wander as far as the 40th degree of north latitude; the determined enemies of the Turkoman tribes subject to or bordering on Persia and Daghestan.* These Turkomans have rebuilt the city of Seraghs (Seerakees), a town about 200 verstes south-west of Mawri.

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* Khiva was built after the destruction of Urgung, once a great and powerful city, and capital of the kingdom of Kharasm, which Khiva now is.—*Translator.*

After the conquest of Mawri, Mohammed-Rahim Khan seized Seraghs; but, not being able to retain it, made it over to his Turkomans as a protection to his hereditary states. From the invasion of Persia other tribes of Turkomans have been incorporated with these people, who were expelled from Mangkichlak by the Kirghiz, and occupy the country as far as 44° north latitude.

The Turkomans who inhabit the shores of the Caspian have constant intercourse with Russia, from whence they import wheat and flour. They are determined enemies of Persia, and in 1813 sent a deputation to general Ritchev (Governor General of Georgia), begging him not to conclude a separate peace with Persia, as they hoped soon to gain some decided success over the common enemy.

The Khan of Khiva has succeeded in seducing the remaining tribes of Turkomans from their subjection to Bokhara, whose territories they now plunder to shew their attachments to their new master.

The rapacious Mohammed-Rahim is suspected of encouraging the plunder of the Bokharian and Russian caravans, and his subjects make excursions into Bokhara, but in small numbers, and secretly; their power being unequal to resist that of Bokhara, which is six times more numerous. In the year 1808 the Khan of Bokhara took Khiva, but restored it to its prince Veledi-Nassar: he died within a short time, and was succeeded by Mohammed-Rahim, who lost no time in recommencing his pillage of the territories of Bokhara. This he continues to the present time, returning evil for the favours conferred on his brother. He likewise attacked the Kirghiz who were established on the banks of the Sir, and carried off a great number of prisoners, whom he has obliged to take lands under Khiva. Mohammed-Rahim has dug a number of canals for the purpose of irrigation, one of which extends 120 verstes from the point in the Amou from which it originally is drawn off.

New Ourghendj is the most commercial of all the towns subject to Khiva, and the principal mart of caravans; it however contains no public caravanserais, where the merchants can dispose of their goods.

The inhabitants of Khiva are composed of Ouzbeks, the conquerors and masters of the country; Turkomans, part of whom cultivate the soil without entirely abandoning their pastoral habits, Cara-calpaks and Aralians, Kirghiz, some Jews, besides the Tadjiks, or fixed inhabitants, of whom we will speak in the description of Bokhara.

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* There are two provinces of this name, it must be a district of Mazanderam.—*Translator.*

Though the inhabitants of both Khanats are of the same race, language and religion, the Khivians have not reached so high a state of civilization as their neighbours; agriculture is less attended to; the habitations inferior; commerce more restricted, and customs more barbarous. The climate is colder, but the soil and productions are nearly the same as those of Bokhara, but not so abundant in Khiva; silk is not exported and bread generally dearer than at Bokhara. We will hereafter speak of the trade with Russia and the Khanat of Khiva, confining the description at the present moment to the route from Saratchik to Khiva.

Saratchik to the wells of Belawli, affording an abundant supply of water—4 marches.

Some wells are met with between that and the Emba of Djem—3 marches.

Sulphurous springs of Ioutch Kanata—2 marches.

To Mansoulmas 3 wells and abundance of water—3 marches.

Here commence the sandy hills, which cannot be passed in less than nine days, three of which are in very deep sand; water is found every two or three days; hills called Aïboughour—9 marches.

Near these wells runs a river cut from the Aral, and ending in a lake surrounded by sand, no water till within sight of Ourghendj—3 marches.

This route, which was performed in twenty-four days, was much more difficult than the one near Aral lake, which is, however, much longer. From Khiva to Bokhara it is 350 verstes.* The Amou is crossed opposite new Ourghendj, or at Khanka, distant from it twenty-five verstes, or at Khezarist, fifty verstes; still lower down there is cultivation for about twenty verstes on the banks of the river. The most frequented passage of the Amou in going from Khiva to Bokhara is at Koukertli (sulphur); the right bank of the Amou is here very steep. In leaving Khiva the road lies on the left bank of the river; the cultivation here extends about five verstes from the stream. The sands commence at Koukertli. There is another road by crossing the river at Tchoutchak (Outchchak) three legged, because these small hills here approach the river. This route is through many sand hills among which are frequently experienced very violent gusts of wind. This is the nearest road.

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* Two hundred and thirty-four miles.

At Koukertli water must be carried, for the distance between tha place and the cultivated lands at Bokhara, which extends to forty verste of that city; indifferent water is procurable at Tcharkoucha. Th route along the banks of the river has less sand, and is much bette but increases the length by 150 verstes.

The Khanat of Khokhan lies to the east and north-east of Bokhara this country has been greatly increased since Tackhend was added to i in 1805, and Turkistan, and all the adjacent cities. It is bounded o the east by deserts, or the Sir-deria; on the south Kachghar-divani; on the east Ala-tagh; on the north Kazakli-djoulak and Sousak; o the south Och and Takht-Suleiman are its frontier towns. The Ak-mesdjid, on the Sir, is very well known by this name, which was given it o account of an ancient mosque situated there, of which the ruins alone are now to be seen. All the caravans from Bokhara to Petropavlosvk pass through this country. I have been told that the Isoun tribe, belonging to the great horde, frequents this neighbourhood. 100 verstes to the east of the Ak-mesdjid is Kuzaklu-djoulak, a small town upon the Sir. In the distance may be seen the northern extremity of the Ala-tagh—this chain of mountains in separating from the Sir loses itself in the steppe and bears the name of Cara-tagh, from the neighbourhood of Turkistan.

Turkistan is defended by a fort, with a ditch of about fifteen feet wide, which can be filled with water. The Karatchik river runs about five verstes from the town, and irrigates the fields. The town has twenty-two wells, and about 1000 mud houses; it has the appearance of decay.

The tomb of Kara-Ahmed-khodja, one of the most revered Mahomedan saints of Turkistan, is situated near a Mesdjid which bears his name; in which there is an immense pot, at least twelve feet in diameter, resting on a stand of cast iron. The rich people dress food for the poor in this utensil, which is distributed on certain days in the year.

The population of Turkistan is composed principally of Kirghiz and a few Ouzbeks.

Tackhend, has at least 3000 houses, and is surrounded with a mud wall falling into decay; as are likewise the houses. The buildings, though intended to resemble those of Bokhara, are much inferior both in construction and materials. There are ten schools on the same footing as those of Bokhara. Canals from the Tchirtchik, which runs about twenty verstes to the south of Tackhend, supply the city with water, and irrigate the lands about it.

The territory of Tackhend produces cotton and silk; of which Turkistan has but a small portion.

The artillery of the beg of Tackhend consists of a few small guns (zumbarooks), carried on camels, like the Persians. In the neighbourhood of the town there are many villages, the principal Djiti-kend, Sairam, Karaboura, Tchimgha, Ikan, inhabited by the Ouzbeks; there are only a few Tadjiks and no Jews.

I have traced the map of this part of the country from a great number of routes. From Turkistan to the mouths of the Sir, from Bokhara, Tackhend, Khokhan, Khodjend, Ouratoupa and Samercand. From the information we were able to obtain it is clear the Russian map of Central Asia is very incorrect for the steppe of the Kirghiz; it is however, far superior to Arrowsmith's, which is still more so. In the constructions of this map, I have not adopted the Russian longitude and latitude of Khokhan and Khodjend; I have approached nearer that assigned by Arrowsmith, without having followed him as an authority.

Khodjend stands on the bank of the Sir, and it is necessary to pass through it on the road from Ouratoupa to Khokhan. This the best but the longest route, a difficult and mountainous country being avoided. The desert road leads from Marghalan to Samercand. Khodjend is a fortress surrounded with fields and gardens like Bokhara.

Khokhan, situated about ten verstes from the Sir, has at least 6000 houses, and is little less than Bokhara. Canals from the Sir convey water to the city. There are no walls round the town, but the palace is fortified and has two gates built with brick.

Khokhan has four caravanserais, where a great number of foreign merchants constantly reside. All the trade between Tackhend, Kachghar and Bokhara, passes by Khokhan. The two countries are constantly at war, but Bokhara is much the most powerful. During the last ten years, the Bokharians have taken Ouratoupa, which was formerly an independent district.

Omar Khan, the present ruler of Khokhan, succeeded his father, Narbouta, and lives in good intelligence with the Khan of Khiva, to whom he is related, and with the chief of Badakhchan, to whose daughter he is married. Marghalan, it is said, is of the same size as Khokhan. This is a very ancient city, as are also Andidjan and Namanghan.

Och, situated at the foot of the Takht-Suleiman, is not so large. This is a great place of pilgrimage; people come to pay their devotions at a small square building situated on the top of the mountain. Tradition states that Solomon sacrificed a camel on this spot; where the blood is shewn on a stone still perfectly red. It is, however, particularly frequented by people suffering rheumatic or other pain; who are said to be cured by extending themselves on a flat stone near the building. M. Nasarov states having seen the ruins of two ancient buildings, under one of which there is a cavern. This is not confirmed by other travellers, who likewise deny the existence of columns. This superstition draws a great number of people to Och.

From Och to Kachghar no towns or cultivated fields are met with; the country is mountainous; the black or savage Khirgiz wander about with their flocks in the valleys of the Ala-tagh. These people have more the physiognomy of Kalmouks than the other Kirghiz, they are brave, and their horses said to be as swift as those of the Tcherkes (Circassians).

The Chinese merchants unite in small caravans, and trade with the Kirghiz of the Ala-tagh; they come from Kachghar and Kouldja, and have nothing to fear from this small nation. The Kirghiz pass the winter in the valleys of these mountains, cultivating a little barley and millet. The district of Iedi-sou (Yedi), seven rivers, is their favourite resort.

In the spring of 1818 they pillaged some villages about Tackhend; this incursion was quickly chastised by 5000 of the people of Khokhan, who made a fortunate irruption into the mountains. I owe the description of these people to a Tartar, who was made captive by them, and was kept a prisoner for seven years. He informs me there are seven of the summits of these mountains covered with perpetual snow, and some fir and cedar trees in the valleys. This Tartar was once exchanged for *thirteen* horses;* another time he formed part of a marriage settlement. He at last escaped with some Chinese merchants, and remained some time at Kachghar; from thence he made his way to Bokhara, and was carried by us into Russia.

From Kachghar to Och, this Tartar forded several rivers, and travelled through a very mountainous country, which was covered with snow, though none was in the valleys. There were many very large trees, but he remarked neither oak nor firs. The descent of the mountains was much longer than the side by which he had ascended, and the cold very severe.

Another traveller informs me there exists almost eternal winter on the Terek. There are three routes to choose in passing these mountains, in which the valleys are avoided on account of the depth of snow. The first that of Belawli or Tallig, to the north of the mountains; second, by the Terek in the centre; the third, that of Chart to the south.

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* I think this must be a mistake; for nine Russian soldiers taken by the Persians were exchanged by the Prince of Casbin for a Turkoman horse, which is always considered the most valuable animal of the two.—*Translator.*

CHAPTER IV.

Kachghar.

From all the information I was able to obtain, the Bokharians call Chinese Tartary, Alti-Chakan, or the six *cities*,[*] viz. Kachghar, Iarkend, Khoten, Aksou, and the two Ilys.

Kachghar is a large city, with a Chinese garrison, to which strangers enter and depart without difficulty. It is situated on a river of the same name, which falls into the Kizil-sou (golden river), which flows between Kachghar and Iarkend, a town on the great road from Kachghar to Cashmere, where they speak the Tartar language.

From Iarkend, the route lays through the towns of great and little Tibet; the country is very mountainous, and the caravans are obliged to make very short stages. The traffic is entirely carried by horses, as camels cannot pass over the rocks and mountains. The route is, Iarkend, four days journey; great Tibet, thirty-five or forty; and Cashmere, twenty-two. Half way between the two last named places, is the town of little Tibet. The river which passes this place is the same as the Cashmere stream, or one of its branches.

It appears probable that the towns, called great and little Tibet by the Tartars, are those more generally known by those of Ladak and Draouse, or Dervazéh. It is strange that none of the Tartars know them by this name;[†] all the Bokharians with whom I have conversed on the subject invariably gave them the application of great and little Tibet; also the Russian merchants, who trade between Semipalatinsk and Cashmere, call them by the same name.[‡]

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[*] More properly countries or provinces.—*Translator.*

[†] The names of great and little Tibet comes without doubt from the habit several Oriental nations have, of giving the name of *belad* or *chehr* indifferently to a province, district or town.—*Note by M. Jaubert.*

[‡] After the publication of this work I met with an account of the travels of a Georgian gentleman, Danibeg, translated from Georgian, and dedicated to the emperor Alexander, from India to the Russian frontier town of Semipalatinsk. I have abridged the facts related by the Georgian as much as possible, the work containing no other matter of interest.

From Cashmere I reached Tibet, a distance of 200 verstes, performed in twenty days.

Between Cashmere and Kachghar, there are no other towns than those I have already mentioned. Immediately in their neighbourhood, there are a few villages scattered in the mountains. Both great and little Tibet are surrounded with gardens. The houses are of wood, as in Russia, and the pent of the roof very high. They are followers of the Grand Lama.

This town is built on rocky hills, among which grow some oats; the inhabitants make a kind of paste of this, by boiling it in milk, which composes their sole provision. They are miserably poor, and the custom exists of several brothers having only one wife. A great deal of tea is used at this place. The wool from which the shawls are made comes from Lassa. Merchandize is here carried on sheep. From here to Cashmere the transport is however on horses.

Note.—Russian goods in considerable quantities might be sold at Tibet, such as silk and goldsmith's works. The Tchabas would readily purchase them. These people bring a great deal of goats' hair from Lassa, which is dispatched from hence to Cashmere. The journey from Lassa to Tibet occupies about three months.

I was six weeks travelling from Tibet to Iarkend; the journey was very tiresome, the looseness of the soil, the great precipices, the immense height of the mountains interspersed with glaciers, made a most melancholy impression on my mind; which was augmented by the complete solitude, for these districts are uninhabited. At last we came in sight of Iarkend; it is surrounded by clumps of trees, and has a very cheerful look.

The Chinese garrison contains about 2000 men; their chief is called Amban: more than three thousand Chinese are employed here in commercial pursuits. The climate of this town is healthy, but the water is bad. There are no fine buildings; the inhabitants appear in tolerably easy circumstances. In saying the climate is healthy I must except the autumn; I never met with any worse. The sky was covered with clouds of a singular kind of dust, of which the cause is unknown: it fell like rain; and the great dampness of the atmosphere gives birth to a kind of insect, called karbites, by the inhabitants, the sting of which is almost always mortal. When the inhabitants see clouds of the above-mentioned dust instead of rain, they hope for a good harvest; and an indifferent one when they have only common rain. The gale of dust sometimes lasts seven or eight days; it is so thick that the rays of the sun cannot pierce through it, and at the same time so fine that it finds its way through the smallest opening.

Besides Iarkend, the Chinese possess Houdam (Khoten,) Gachghire (Kachghar,) Aksou, Douroban and Ily; each of these cities have a governor of this nation. The Chinese are very numerous at Ily or Kouldja; indeed the number is said to amount to above 10,000. They are very proud and lazy, and spend all their time in smoaking. No inhabitant can leave the town without a passport; and it is very difficult to escape this precaution, as the surveillance of the authorities here is very severe. It is one of the means made use of by the Chinese to put a stop to disorders of all kinds.

From Iarkend I took thirteen days to reach Aksou. This Town is not larger, but contains many tolerably well built houses; it is situated in a valley, and divided into two parts, the one inhabited by the Chinese, the other by Mahomedans, who keep up a constant communication with each other. From Aksou, I was three days going to Tourfan, a small and ugly town. As its inhabitants are very few, it contains nothing worthy of remark. The frontiers of the Kirghiz country are about twenty verstes from this place. After leaving Tourfan, I passed several wandering tribes of Kalmouks, Kirghiz and Kaisaks, and at last arrived at Semipalatinsk, after a three months journey.

I have fixed the frontier of great Tibet in 35° 50′ N. lat. and 76° 35′ E. long. from Paris. The following latitudes and longitudes I have drawn from the tables of the great Oriental geographer Oloug-beg, which I procured at Bokhara; and I place them beside those to be seen in the edition published by Gravius in 1652; the latitude of Bokhara is the only one I have been able to verify, and found correct to within about two minutes.

Table of Latitudes and Longitudes according to the Bokharian Manuscript.

Names.	Latitude.	Longitude.	By Gravius.	
	° ′	° ′	Latitude.	Long.
Bokhara	39 50	97 30	....	96 30
Samercand	39 37	99 16	... .	
Carchi or Nesef	39 „	98 „	....	
Khodjend	41 55	105 35	....	100 35
Badakhchan	37 10	104 24		
Anderab	36 „	108 45	....	103 45
Kech	39 30	99 30		
Koubadian	37 45	102 „		
Talikhan	37 25	102 50		
Khowarezm or new Korkandj	42 35	93 45		
Darghana-tach or Korkandj	42 17	94 30		
Hezarasp	41 „	95 „		
Kath	41 36	95 „		
Darghan	39 30	94 15	....	95 5
Isfidjab	43 36	99 50		
Taraz	44 31	99 50		
Ourouchna or Osrouchnah	40 „	105 „	....	100 „
Saghanian	38 14	105 30	....	100 30
Bech-kend or Penkat	43 „	101 „		
Ilak or Tounkat	43 25	101 „		
Ferghana or Akhsekat	43 25	101 20		
Ourkend	44 „	102 50		
Och	43 20	102 20		
Kachghar	44 „	106 30		
Houchach or Tchadj	42 30	109 „		

The accounts given by Oloug-beg do not agree with these I have obtained elsewhere; they are, however, so far curious, that this author mention towns which no longer exist, and of which no traces even are left: perhaps, however, I might have been able to give some interesting information concerning the ruins of these towns and the history of their destruction, had opportunities occurred of consulting Bokharians possessed of more intelligence than those that fell in my way. From Kachghar to Semipalatinsk, the journey occupies fifty-five days, twelve of which are to Askou, and twenty-five to Kouldja.

We are informed in the excellent work by M. Ritter, that th easiest passage among the mountains to the north of Kachghar is nea Aksou. I ascertained the truth of this statement; nevertheless the ca ravans always go round, and have good reasons for taking another roa

In going from Kouldja to Aksou they keep near the Chinese frontie because they are sure of not being pillaged. In the same way, th caravans from Khiva, when they go to Orenbourg, pass by Saratchik o Saratchikova, and afterwards keep along by the Oural, instead of goin from Khiva to Orenbourg by crossing the steppe of the Khirghiz.

From Kouldja to Semipalatinsk, the widest river is the Alaghouz; it flows to the north of the Tarbaghataï hills; the highest mountains are the Tchoulk-caraghai, 100 verstes from Kouldja; it takes two days to cross them.

There are two Kouldjas, the great and little; both situated on the Ily, and about forty verstes from each other. The caravans pass by little Kouldja, which lies to the north of the other. It is a fort without the slightest resemblance to those of Bokhara. It is more like an European fortification, having projecting angles and a species of bastion; a gun fires at sun-set, and the gates are immediately closed. The governor of the place has the title of Dziangghioun, and the police master that of Kalatai. Three Kirghiz and five Chinese had been beheaded for various crimes in the course of three months. Near the temples are idols of different sizes, made of clay, with embroidered dresses, and their hands folded over the stomach. Inside the temples the idols are generally of gold, enclosed in glass cases; bread is placed before them.

Kouldja, in the Chinese Dzoungarie, is defended by a garrison of about 10,000 Tchanpan, or Chinese foot soldiers. This town has six gates, and contains about 9000 houses, built of mud or wood. There are also some built of stone, and they all have roofs like Russian houses. Kouldja is not surrounded by fields; there are half a dozen villages inhabited by Chinese, at about thirty verstes from the town.

The Talku mountains are covered with magnificent forests, which supply Kouldja with wood. Generally speaking, the Kalmouks in this country are wandering tribes; a few have taken service under the Chinese, but in general there are very few with fixed occupations.

Besides the Dounganu-Tartars, a great number of Chinese are found at Kouldja: they are distinguished from the Kitaizi, or black Chinese, whose women have small feet

Near Kouldja the Ily is hardly more than 100 feet wide, and it may be forded in most places.

CHAPTER V.

Khanats of Hissar, Koulab, Ramid and Badakhchan—The Ghaltchas—Gold found in the Derwazeh river—The Siah-pouches—Khanats of Chersabés.—Itinerary from Bulkh to Caboul, and from Bokhara to Herat.

We have now to consider the countries situated to the south and west of Bokhara. We find the Mahomedan Khanats of independent tribes, who profess the religion of the false prophet, and others who do not believe in him, and are called by the Mahomedans infidels; all their people inhabit a mountainous country.

The richest of these states is the Khanat of Hissar. The Khan resides in the city of the same name as the province; it is situated about fifteen verstes to the west of the banks of the Saridjouī, or Kafer-nihan. He is father-in-law of the Atalik; and the faithful ally of the Khan of Bokhara.

The town of Hissar contains about 3000 houses; it is situated in a well cultivated valley, abounding in pasturage; almost all the inhabitants of this country are Ouzbeks, but a few Tadjiks are found in it, most of them very rich It is said that the Ouzbeks sometimes bring millet to the market; and, if they are unable to sell it, they throw it away, to save themselves the trouble of carrying it home. They possess considerable flocks, and are, to a certain degree, in easy circumstances.

The towns depending on the Khan of Hissar, are Deīnaou, the most considerable after Hissar; Saridjouī, Toupalak, Regar or Reg-ara, Canatagh, Dechtaband, Tchockmazar and Khodja-Taman. At the last place there is the tomb of a saint highly revered by the Mahomedans.

Ramid, 100 verstes north of Hissar, is a pretty large town; its khan commands the services of 10,000 men in his excursions. One of the highest mountains in the country rises near Ramid.

Koulab, containing about 3,000 houses, is to the east of Hissar, on the road from Badakhchan to Khokhan; it is independent. All these towns are inhabited by Ouzbeks, of whom a great number are agriculturists.

The khan of Abi-gherm is often at war with that of Hissar.

To the south of all these towns is the Khanat of Badakhchan; its capital, which bears the same name, but which is also known by that of Feizabad, is situated on the banks of the Badakhchan, which falls into the Amou. It is one of the most important Khanats of this quarter, though it furnishes no articles for commerce that I am acquainted with, except lapis-lazuli; besides it is not on any of the great co mercial roads.[*]

To go to Cashmere from Badakhchan, the route lays either throu Kachghar or Peichawer,[†] which appears to indicate that the mountai which separate Badakhchan from Cashmere are impassable.

In the mountainous country east of Bokhara and north of Hissar, a found the Ghaltchas, a poor but independent people, professing t Mahomedan religion, of the Sunnie sect. Russian travellers give the the name of Eastern Persians, and they know no other language; th features differ much from those of the Tadjiks, and are even of a dar er complexion than the Arabs of Bokhara. They inhabit miserab cabins in the valleys, are all cultivators, possess some cattle and ve few horses.

Matcha and Ignaou are towns inhabited by the Ghaltchas, and sit ated to the north of Khokhan. A great number of Ghaltchas 'freque this place, to exchange their goods for what they require.

This people extend further and further into the mountains, which a at present little known. Beyond is the country of the Kafirs, wl they represent as a savage and barbarous race.

After passing Karateghin no more Mahomedans are met with. Tl inhabitants of this town are, however, not barbarous; the redoubtab Kafirs dwell in Calei-khoum, called also Derwazeh, and situated on river of the same name. The country between Hissar and Derwaze is so mountainous, that it is often necessary to lead the horses by tl bridle. The roads are excessively narrow; and the precipices ve steep, at the bottom of which the Derwazeh rolls with a thunderin stream. Gold is found in the sands of the Derwazeh. For carryin water, skins are generally used in Bokhara, which preserve the form the animal to which they once belonged. Those of sheep or wild goa are considered the best. They are filled by an opening left at wh was the neck of the animal. The Bokharians tie the water-skin to rope, and throw them into the Derwazeh; the violence with which runs soon fills the skins with mud, sand, and some gold; which last is afterwards easy to separate from the mud by washing; but as it never without alloy, its relative price to that of pure gold is as 18 to 2 This custom may serve to elucidate a passage in Herodotus, where h describes the means used by the Indians to obtain gold from sand.

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[*] There is a route through Badakhchan to Cashmere and Tibet, not through Cashg or Chinese Tartary.—*Translator.*

[†] A third road as I before mentioned ascends the Oxus to its source, and goes by Judu —*Translator.*

To the south and the east of Badakhchan are found the Siknans or Siah-pouches, a half wild, wandering, people. They are not Mahomedans; are clothed only in the skins of black sheep, and their name, which signifies black clothing, is derived from their dress. Their country lies in the direct road from Khoulm to Peichawer. It is then necessary to pass by Tchetrar, their principal town, by Koundouz, and through such a mountainous country, that the roads are almost impracticable; and for that reason this road is very seldom taken. The khan of Badakhchan is constantly at war with this people, and prisoners then taken are sold by the merchants of Badakhchan at Bokhara.

There is an independent Khanat in Bokhara, Chersabés, or Chehrisebs, so called after its principal city, which is situated on a river of the same name. It is the same as the Kachka, which passes by Carchi, one of the largest towns of Bokhara. This river has several times preserved the independence of the Khanat of Chersabés, became, by means of dams, the whole country surrounding the city and fortress may be laid under water, which effectually prevents the Bokharians from taking possession of it; besides this the Ouzbeks of Chersabés are celebrated for their courage.

This Khanat, which had been joined to Bokhara by Mohammed-Rahim khan, separated itself again from it at the death of that prince. The loss of this territory must have been sensibly felt by Bokhara, for it is rich in various productions, and a river runs through its whole length. Very good cotton and roots for dying are sent from thence to Bokhara, and they receive in exchange iron, leather and other merchandize from Russia.

The khan of Chersabés can bring into the field an army, or rather *levée en masse*, of about 20,000 men.

The cities dependent on him, are Kitab and Douab, two fortresses, Djaouz, Pitahaneh, Iakabak and Outakourghan. Chersabés is besides deserving of attention from the circumstance of its having been built on the site of the village of Kech, the birth place of the famous Timour.

I will now lay before the reader two routes; one from Balkh to Cabool, the other from Bokhara to Herat—and will add a few words concerning the Khanats through which the roads lie, which will comprise all the information I was able to attain relative to the Khanats lying round Bokhara.

Nothing is more variable than the limits of a Khanat in Asia; for example, Balkh, which is probably the ancient Bactra, belonged to an independent khan; the shah of Afghanistan dispossessed him of it about fifteen years ago; but Kilitch-atia-khan, of Balkh soon recovered his independence; and, at his death, in 1820, he recommended his two sons to the khan of Bokhara.

In the following year, Kataghan, chief of the tribe of Ouzbeks of Tchehlminar (forty towers), made incursion upon the territory of the two youths, and drove them out. Upon this the khan of Bokhara dispatched a force of 12,000 men against Kataghan, and forced him t take shelter in the fort of Balkh, where they hoped soon to take his prisoner; affairs were in this state when I left Bokhara.

In going from Balkh to Caboul, the first day's halt is at the tomb of the shah Merdan; where there is a small hillock. The second stage is to Khoulm, an independent town; when it belonged to the Afghans, a duty of two and a half per cent was exacted upon all the merchandise belonging to the caravans that passed by; the same duty was also levied at Balkh and at Bamian.

After Kilitch-Ali, khan of Khoulm, had thrown off the yoke of the Afghans, he no longer levied any tax upon travellers. A Mahomedan law forbids all persons who cannot keep a standing force of 12,000 armed men to receive any other tributes than the *zekat* and the *ghar chour*; and consequently does not permit them to tax travellers

The son of Kilitch-Ali, whose religious scruples were less than his father's, re-established the duties. He died about three years since

It is said that five rivers unite at Khoulm and form a cascade. The Khoulm river falls into the Amou. I have been assured that the city of Khoulm, properly so called, has been entirely destroyed, and that the town now bearing that name is the one formerly called Tachkourghan, about sixty five verstes from Balkh.

It is a day's journey from Khoulm to the fort of the Aïbek. The road lies along the river of Khoulm, which rises in the country of the Douab, at the distance of about four day's journey. The banks of this river are covered with fields and gardens.

A river rises in the country of Feizabad, which falls into the Khoulm near Aïbek.

The distance from Aïbek to the Douab is reckoned at fifty-six verstes from Aïbek begins the magnificent valley of Arizandan, full of gardens; and eleven verstes farther is the town of Serbagh.

After a journey of twelve verstes from Eiba, we arrive in Ghourram a country filled with villages, and very thickly peopled. By following the source of the Khoulm river, the road lies through a valley, which becomes very narrow at fifteen verstes from Ghourram, near Roui close to this village the road turns to the left, to Douab, at the distance of about forty verstes.

Here it is necessary to cross the mountain of Carakoutal, which occupies half a day. From this several small fortresses, or villages, surrounded with water, are passed; and the inhabitants furnish provisions to the caravans. These castles are known by the name of *Mader.* Eight verstes farther are other fortified villages, called Kameder, and surrounded by fields and vineyards. They are supplied with water by the sources of the Enden, lying just to the south of these forts. Half a day's march from Kameder brings the travellers to Saikan; after having crossed a very high mountain called Nalifarch. At twenty verstes from Saikan rises the mountain of Agrabad; the fortress of the same name lies at its base. This country is rich and well cultivated, possessing mines of copper, silver, and gold. The shepherd there mounts guard; that is to say, all the inhabitants are soldiers; in spite of which, they have been unable to maintain their independence, for the fort has successively been subject to the shah of Afghanistan, and the khans of Koulm, shewing the possessions of the latter to be sometimes of great extent.

Beyond Agrabad there are some small hills, and after passing them, and travelling 20 verstes, we reach Bamian, a very ancient city, containing about 20,000 inhabitants, and surrounded by numerous villages. In the neighbourhood are many rivers, and grottoes, containing sculptured figures; and on the summit of a neighbouring mountain, there are two statues of prodigious magnitude.

I was assured each of them was 20 toises in height, and a Hindoo told me one of them was a representation of their god Rama. These colossal statues have long been celebrated in Europe, and are still in existence. A Cashmerian told me gravely that the shah Merdan (probably the one buried between Balkh and Khoulm), had killed a dragon that had long inhabited the summit of one of the Bamian hills, and that the tears which fell from the eyes of the monster gave rise to the streams which have ever since watered Bamian.

The country is defended by 56 forts. A ruined town, called Mouja, or Mija, lies a day's journey to the north of Bamian.* At three verstes from Bamian the river of the same name flows towards the east. The fort of Toptchi is 2 verstes farther on. At this place is crossed the Choutour-Gherdan, the highest mountain between Balkh and Caboul.

The traveller then reaches Kalou, a fort in the midst of mountains, and containing about 200 houses; nine verstes farther he passes the fort of Hadjihab. He then meets with a mountain and a village, whose name is apparently Arabic, containing only about 40 houses.

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* The city of Bamian was destroyed in 1221 by the Mongols, who massacred all the inhabitants; for this reason they gave this city the name of "dwelling of sadness."

It is afterwards necessary to travel 40 verstes, through a mountainous country, to reach the three forts of Bikala, or Gherdan-Divani; after half a day's journey, through a gently undulating country, the sources of the Ser-tchechmeh* are attained. They form a large basin, and the oriental travellers, who are all lovers of the marvellous, record that it is inhabited by miraculous fishes, with pearls in their noses, and which occasion the death of any person attempting to catch them. This is the real frontier of Afghanistan; Caboul is at the distance of nine *farsakhs*, or about seventy verstes.

This route was communicated to me by a merchant, who had travelled at least thirty times from Bokhara to Caboul; it shews the distance from Balkh to this last town to be 392 verstes, and it takes the caravans twelve days to perform the journey. The Ouzbeks extend along this route beyond Bamian. The mountainous country just before reaching Gherdan-Divani is inhabited by Kezareh; and after passing this fortress the country of the Afghans commences.

I shall only detain the reader by a few words regarding the princes of Afghanistan. Kamran, governor of Herat, is the son of Mahmoud Shah; this latter was king of the country and had a vizier named Fatih-khan, a man belonging to one of the principal families, and had seventeen brothers, the eldest of whom Mehemed-Azim-khan was governor of Cashmere.

Kamran, jealous of the power of his vizier, induced him to come to Herat, and then put him to death. This atrocious action, which took place in 1819, was the signal of a general revolt in favour of the family of the vizier.

Mahmoud, forced to fly from Caboul, took refuge at Herat, having there established a state independent of Afghanistan. Mehemed-Azim-khan hastened to Caboul, installed himself there as prime vizier, and left nothing but the empty title of shah to a relation of Mahmoud-khan.

Perhaps the English are not altogether ignorant of these internal dissensions, which greatly weaken Afghanistan; on the other hand, its inhabitants, divided into parties, might easily fall into the hands of the shah of Persia, and under him become a formidable and powerful neighbour to Hindoostan.†

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* In Persian Sir-cheshma or head of the springs.—*Translator.*

† It is singular that two of the members of General Yermaloff's mission should have almost immediately on his return been despatched into Tartary; General Nigirey a Greek and Turkish interpreter to Bokhara; also Captain (now general) Mouravieff to Khiva, who both point out this as a route by which the British in India might be threatened, if not attacked.—*Translator.*

The Seiks took advantage of the absence of Mehemed-Azim-khan to possess themselves of Cashmere, and this gallant people now reign in the beautiful valley of Sirinaghor.

The route usually pursued from Bokhara, to the city of Herat, containing about 4000 houses, passes by Kirki upon the Amou and by Ankoi. The country along this route is only cultivated to the distance of twenty-five verstes from Bokhara. The steppe there commences, in which the Kirghiz who accompanied us graze their camels.

After having travelled about 150 verstes, we passed Carchi on the left, and arrived at Kirki. The principal routes from the Amou to Herat pass by this place, and Tchardjoui: double the extents of sandy plain is crossed by taking the road from Tchardjoui to Mawri, or Meer, as in going by Aukoi and Kirki, a small fort, containing 100 houses, and surrounded by a wall with battlements and a ditch.

It is said that the Amou at this spot is more than 200 toises broad, and four or five deep; its banks are rocky, very steep, and about three or four toises high.

Ankoi is a large and independent town, containing about 4000 houses, inhabited by a small number of Ouzbeks and few Tadjiks, and a great many Arabs.

A small river runs by this city; it dries up in the summer, and the inhabitants are obliged to dig wells to procure water. Ankoi is about 100 verstes from Balkh, and 120 from Kirki. From Ankoi to Meimaneh the distance is about eighty verstes. There are a few villages in this road. Meimaneh is a town containing about 1000 houses, and inhabited by Ouzbeks, who resume their wandering habits during the summer season; they are confirmed robbers, pillaging the caravans; and are frequently at war with their neighbours, make incursions into Khorassan, and carrying their prisoners to the slave market at Bokhara.

Beyond Meimaneh and as far as Herat, the country is mountainous; but contains some roads practicable for artillery. From Meimaneh they count about sixty verstes, to Mourghab, a river six toises wide, whose banks are rocky. It is only on the banks of this river that some willow and poplar trees are ever found; on all the rest of the route there are nothing but bushes and pistachio trees, the latter in great abundance.

The Eimaks and the Ialountouches wander among these mountains, and along the side of the Mourghab; they are Mahomedans of the Sunnie sect, and speak Persian; their features more resemble those of the Tartars than the Ouzbeks; they inhabit about 3000 felt tents, or kibitkas, and are greatly addicted to pillage. If a small caravan has occasion to pass through this country, it is necessary to obtain the protection of one of the chiefs, and he will then accompany the travellers, and serve them both as a guide and protector. About 30 verstes beyond the Mourghab, the route passes to the left of Mawroutchak, a town about 180 verstes from Mawri. From the banks of the Mourghab to Herat is only fifty verstes; according to the distances laid down in this route Herat is 310 verstes from Kirki.

Among the people inhabiting the neighbourhood of Bokhara, of whom I have spoken, it is possible there are some unknown, in which case I shall have attained my object, if I have contributed any thing to the geographical information, though not complete, to that already possessed, concerning these distant countries.

V.—*On the advancement of Geological Science in India.*—*By Captain* J. Campbell, *Assistant Surveyor General.*

In the study of the fossiliferous and stratified formations of Europe, considerable progress has been made of late years; but, eclipsed by this fascinating employment, the study of the primary rocks has been almost quite neglected. Dr. Boase remarks* "that, with the exception of Dr. "Macculloch, no geologist of note, in this country, has published any "minute, and descriptive details concerning the primary rocks; all "have been absorbed in the pursuit of the wonderful and fascinating "knowledge unfolded by the fossiliferous strata." The same author remarks that Professor Sedgwick has pointed out the necessity of attention to the study of the primary rocks, and that De La Beche is engaged in the examination of Devonshire. The Islands of Great Britain afford but few opportunities for the study of primary geology, the tracts are few and confined, and it may be even doubted if there is any formation of true granite, or formation in which granite prevails. Even in the rest of Europe, where the primary rocks prevail, the climate impedes, in a great measure, any proper examination. In the absence of a sufficient collection of facts, on which to base a theory, the consequence has been, that authors have promulgated various conflicting systems. One supposes the stratified primary rocks to have been formed by aqueous action from the debris of the unstratified rocks; another, that the stratified primary rocks are of aqueous origin, and of prior formation to the unstratified, by which they have been metamorphosed and indurated. And lately Dr. Boase produces plausible evidence of both stratified, and unstratified being of contemporaneous origin.

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* Treatise on Primary Geology, 1834.

The peninsula of India presents a vast field for the study in question, where the formations, of enormous magnitude, extend sometimes for 50 miles, presenting to view the same kind of rock, until its peculiarities and varieties can no longer be overlooked. Compared with this vast field, the primary formations of Great Britain and even of Europe sink into insignificance, and we require nothing but energy and application, to collect the necessary knowledge, and possibly to unravel the law by which the formation has been aggregated. Towards the point of the peninsula, it appears that granite is the prevailing rock, without any kind of schist or stratified rock to conceal it from our view. As we advance northward, we find the surface clothed with schists, limestones, and trappean rocks; and, possibly, to the extreme north, the secondary rocks may prevail, indeed we know them to be fossiliferous. But of this vast continent, we know comparatively little. With the exception of a very few, but excellent, papers, giving minute descriptions of small patches, we have no data to turn to. We hear of mines of the common metals, and of diamond mines, &c. but generally the mineralogy has been entirely neglected. We know nothing of the probable metallic resources of the country; and of the metals rare and scarce in Europe, we have not once any mention, though I have reason to believe that titanium exists in great profusion, and possibly many others of the same kind. Because these minerals are almost unknown in Europe, it is no reason that they may not be brought into use in the economy of the arts, if we can produce them in sufficient quantities; but to do this, we must attend to the aids which chemistry affords us.

The complaint of want of geological description, is not, however, confined to India alone. Dr. Boase remarks, "In most of the lately pub- "lished geological accounts of countries, we look in vain for details con- "cerning primary rocks: we sometimes, indeed, hear that such, and such, "a district consists of granite, but cannot collect any information con- "cerning its composition, or the manner in which its varieties are asso- "ciated together. We are left quite in the dark as to the nature of this "kind of rock: for the various kinds which may come under the desig- "nation of granite are not only exceedingly numerous, but have very "frequently no resemblance whatever to the common variety so uni- "versally known by the name granite."

For want of the necessary details alluded to by Dr. Boase, much of the information which has been published, descriptive of India, is of little use. We are told that gneiss abounds in Ceylon, but I believe, it will be found that gneiss is as rare there, as in South India. Dr. Benza has asserted that hornblende slate is common in Salem; he probably made use of the term in its generic sense, following Dr. Macculloch; but the truth is, that hornblende slate is almost unknown in the district of Salem: but had a description of the mineral been appended, we should have been led into no mistake.* Observers therefore should in future be careful to append mineralogical descriptions of the rocks to which they allude, or at least to make accurate references to mineralogical works, where the description of the characters agree. An attempt is sometimes made to shew that this attention to mineralogical minutiæ is not necessary, or to assert that the name of a mineral or rock, sometimes depends on its geological position; but this can never stand good: we cannot make a sheep into a horse, by putting it into a stable; and many cultivators of science may be sceptical on what are called "the principles of geology," or even deny the dogmas of theorists altogether. Dr. Boase remarks "If a "rock be designated according to its geological relations, its name "must be liable to change, because the principles of the science are "not, as yet, permanently established: besides, on this plan, in the "examination of countries previously unexplored, too much depends "on the correct judgment of the observer: but when a rock acquires a "name, from the nature of its composition, whether purely mineralogical "or blended with organic remains, then this part of the science becomes "perfectly descriptive, like the other branches of natural history; and "much curious and accurate information may then be expected from "travellers, who are not accomplished geologists."

Another common error with observers, is the application of the mineralogical name of a rock, to many of the varieties which are intermediate between it and some other mineral: this should carefully be avoided, and the typical specimens of the rock, having been once described, its varieties when mentioned should be named "varieties."

Another error is the abuse of the term "decomposition"—every rock which is soft or friable, is called decomposed, very often without the slightest proof. The chalk of England is soft enough, but not I believe considered generally as decomposed. It is common to call the Indian cotton or regur soil, "decomposed" from trap rocks. It resembles in some measure the lias clay of Dorsetshire, as far as my memory can carry me, but I believe the lias of England was never called decomposed. It is common in India to find fissile, friable, gneiss embedding round blocks of granite, and this gneiss has been termed "decomposed." It might have disintegrated in structure, but decomposition is impossible, because that would have destroyed the fissile structure. Disintegration, and decomposition, are two very different operations—the one mechanical, the other chemical. An instance of disintegration without decomposition is seen in the masses of quartz rock in India, which are always disintegrated, but never decomposed. In India, a piece of quartz larger than the cube of one inch can never be found without cracks, but it never presents any appearance of decomposition. If we heat a piece of glass, and plunge it in cold water it falls to powder or cracks to pieces, it is disintegrated, but not decomposed. Each particle is still a silicate of soda. In the same way most crystalline particles of disintegrated rocks will be found to have a porphyritic or a granular, aggregated structure.

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* I am concerned to hear, that this talented officer, Dr. Benza, who must be considered as having led the way, in first drawing attention to the geological examination of the South India, is now no more.

In collecting information on Indian geology, the greatest difficulty appears to be, that the number of people, who have time and opportunities for the pursuit, are very few; but if every one who chooses to attend to the subject, would apply himself, to compile accurate descriptions of the part of the country, adjacent to their stations, we should soon have a valuable collection of the geology of isolated spots, which those who are employed by Government in these scientific pursuits could soon and easily connect together. In the furtherance of this end, a geological society would be of the utmost advantage—they would receive and assist in the discussion of such information, compare specimens, have chemical examinations made, and afford that information and directions to tyros which no printed work on the subject could give,—and particularly any individual of the society who has had the advantage of studying the science practically in Europe, could then afford the most valuable information, in identifying minerals with those of Europe.*

In the study of the primary rocks, we cannot advance one step without the aid of mineralogy, but this science unfortunately is still in its infancy, and even the principles on which it is to be based are not yet agreed on. Mohs, in his system, considers the crystalline form alone, and rejects all minerals which are amorphous. Dr. Thomson, in his valuable work of 1836, shews that the chemical composition is the best basis on which to classify minerals, and he gives the component parts of nearly 500, many of which were analysed in his own laboratory. In the elementary state of our knowledge on this subject, it is not to be wondered at, that many discrepancies occur. Klaproth gives an analysis of hornblende, by which he makes it ferruginous, containing thirty-three per cent of iron, and only three of magnesia, but Dr. Thomson's hornblende is magnesian, containing thirteen per cent of magnesia. There is little doubt, but that the two specimens must differ much in appearance, and we may therefore avoid the mistakes, which would be produced by preserving typical specimens of the minerals to which we apply a name.

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* This Journal is published by a Society, of the prototype of which it was declared by Sir WILLIAM JONES that "the bounds of its investigation will be the geographical limits of Asia; and within these limits its enquiries will be extended to whatever is performed by man or *produced by Nature.*" The sub-division of scientific labour does not seem called for here as in Europe, where there are so many labourers in the field; so that a Society for the cultivation of each science is not desirable; and the Meetings of the MADRAS LITERARY SOCIETY may be made the place of reunion for all geologists, and its already large mineralogical cabinet the receptacle for specimens. Our correspondent is reminded that the Society will be thankful for specimens illustrative of his remarks, which are usually transmitted by Authors.—*Editor.*

Mineralogy considers only single minerals, and compound rocks composed of these minerals are therefore excluded from the science. This subject, a sort of "rockology," might be considered a science of itself, but we are destitute, almost entirely, of any information on the subject. Dr. Macculloch is the only one who has given it sufficient attention. His work "On Rocks" of 1821, however, has many objections, and although very useful, a fresh work is very much wanted. The nomenclature also requires complete revision to prevent the absurd contradictions that writers have fallen into. We find *eurite* defined by the best authorities as "felsphatic granite containing crystals of felspar,"—"a granite composed principally of felspar, finely granular or nearly compact," —"composed principally of compact felspar"—as being another term for "compact felspar." Chert is called "hornstone"—"indurated lime stone"—"a modification of silicious earth"—"Paris burr stone"— "a cavernous silicious rock." Hornstone is, "flinty slate without the slaty fracture"—"silicious schist"—"strongly resembles basalt."—Diallage rock is "diallage and saussurite" "diallage and felspar." Saussurite is "hard silicious serpentine"—"jade or anestone"—"nephite," and so forth : the names being applied at the fancy of the observer, until they may be shewn to mean literally nothing. The multiplication of *names* I consider to have caused the greatest injury to the science, and I conceive them to be by no means necessary, for by combining the generic term for a mineral, with other terms, denoting the structure &c., I think we may in great measure avoid their use without being misunderstood. As an example we may take a single mineral "hornblende;" then we have "*crystalline* hornblende," or aggregated in large crystals; "*granular* hornblende;" "compact hornblende" (if such a rock be found); "*granitic* hornblende."—Hornblende rock or black granite,—"hornblende porphyry."—Hornblende in grains embedded in a paste of felspar, the porphyritic sienite of Jameson, "schistous hornblende porphyry."— Hornblende slate, "foliated hornblende." Hornblende in scales (if such a rock be found), lamallan or schistous hornblende, an homogenous rock like argillaceous slate. A term for greenstones might be easily found, to denote the partial admixture or combination of the structure of the hornblende porphyry, without miscalling *black stones, green stones*. The term schistous, too, has been most sadly ill used, so that it is difficult to say what it means. If we take argillaceous schist as a type, it means a rock homogenous in structure or in the composition of its parts, which has the property of *drawing* into laminæ. Then we have no other kind of schist, but granite in India, and quartz rock in Norway, which Boase (page 79) tells us "separates into very large plates, several feet in length, and only a few inches in thickness like marble tables." Schistous hornblende will be unknown, and mica or common talc may be considered schistous. Gneiss is scaly in structure, in the same way that mica slate is—to this structure the term "foliated" might be applied. The term "porphyry or porphyritic" might be used as Dr. Macculloch defines it, "crystals of one mineral embedded in a continuous mass of another." We might then say hornblende in felspar porphyry—and dropping the proposition "hornblende felspar porphyry" —then we have "red in white felspar porphyry"—"quartz felspar porphyry"—"felspar quartz porphyry," or crystals of felspar embedded in a paste of compact quartz—all of which are found in India.

For the last two years, I have been engaged in a geological and mineralogical examination of the Salem district, and I find many discrepancies with the theories of European geology, which it will require much labour and assistance to clear up. In Dr. Boase's work, I find many points of agreement between the geology of Cornwall, and Dr. Macculloch's description of the Scottish Isles, with that of India, which are therefore quite at variance with the prevailing system. In the pursuit of my object, I have examined a tract of country in a triangular shape, included between Trichinopoly, Bangalore and Vellore, of which the district of Salem alone contains 7.000 square miles, equal to one-sixth of the area of Great Britain. In this tract I find so many new minerals, that I have not yet had time to examine them all, and perhaps it may be impossible for a single individual to make all the chemical analysis required. I find that hornblendic granite prevails over all this tract, that it forms a substratum at depths more or less under the surface, the rivers cutting their beds down to this rock. It occurs above the surface generally in rounded masses, heaped together, the rounded form of which has been generally attributed to decomposition, but which is not the case, the shape being original; in which way it is found embedded in friable gneiss, or kaolin earth, which fill the interstices between the blocks, and are washed out on exposure to the weather. Black granite (hornblende rock or primary greenstone), and also trap, are found in the same way. The hollow of the valleys between the ridges of granite are filled with irregular beds, of generally friable rocks of pegmatite, porphyries, hornblende slates, quartz rock, of which the porphyritic is the prevailing structure. The surface of these beds is singularly level, and is covered generally with soil formed from the disintegrated, and decomposed rock. Micaceous granite is very scarce, or occurs only as a variety of the hornblendic gneiss, as a formation, is unknown, and occurs either embedded in the granite or as filling the interstices between its blocks. What has been called gneiss, is hornblendic granite with a concentric lamellar structure, which is a prevailing structure in the granite formation. The formation of which the Palicondah hill is a type, called sienite by Dr. Benza, is a common variety of granite, it forms the hills of Amboor, of Congoondy, and the hills between the Cauvery, and Collegaul in Coimbatore. It is felspathic, and yields easily to the decomposing power of the weather; it has no cleavage, and contains generally much mica, in veins or patches, and trap dykes prevail in association with it. It is characterized by its appearance, which is that of a craggy granitic mass, covered nearly to its summit by a conical heap of large grained reddish gravel. A spheroidal or concentric lamellar structure is common in the masses of globular trap, which causes them to peel in pieces like bits of a rusty shell; this structure is original, and is in no way affected by the action of the weather. The hills and masses of black granite and trap occur as portions of the granitic formation, and can in no way be considered as accidental concretional varieties. Masses of hornblende felspar porphyry occur embedded in granite, proving thereby their *prior origin.* Argillaceous soils in Europe are generally attributed to diluvial or alluvial action, but in India they also occur as original primary formations, connected by veins with the subjacent rocks, and embedding masses of granite in situ, as shewn by veins of quartz intersecting both rock and matrix. The formation of this kind, prevailing at Bangalore, which may be called the Bangalore clay, is an immense and extensive tract of an indurated argillaceous sandstone, which something resembles (as I am informed by Mr. Burr) the new red sandstone of England: it lays immediately upon the subjacent granite, into which it graduates. I have omitted to mention, that basalt also occurs in hornblendic granite, not as dykes, or veins, but as an integral component part of the rock, and in what may be called "lenticular" veins in the middle of the blocks. It will be easily seen how irreconcilable some of these observations are with prevailing theories, and, it is to be hoped, that we may, in future, find theories laid on the shelf a little, and allowed to take care of themselves, while observers will confine themselves to a minute, and accurate examination, and description of nature. I cannot close these remarks, without acknowledging the great assistance I have received in these labours from Dr. W. Gilchrist, of Hoonsoor, and regretting that his state of health has prevented his making public his own observations on that part of the country. To Mr. W. Burr also I am indebted for several valuable hints, which his great practical knowledge of the science in England have enabled him to offer in a late conversation.

Since the above remarks were composed, the 25th No. of the Journal has come to hand, with the Editor's remarks on some errors of Dr. Benza's which I have pointed out. It was by no means my intention to point out, or to prove, the errors of any particular individual, but to shew the disadvantages arising from neglecting the chemical composition of a mineral. To shew this practically, I selected those errors committed by Dr. Benza, whose well known practical information, might be supposed to preserve him from such mistakes. As it would weaken the force of my argument to allow that the rock in question is so plainly not hornblende, I must remark, that my specimens which are broken from the basement of the pillars of the old durbar, would defy the most experienced mineralogist to say what the composition of the rock is. The colour is exactly the same as hornblende rock, the fracture is granular, the structure granitic, and it in no way resembles any variety of steatite. On referring to No. 12 of the Journal, page 13, it will be seen that Dr. Benza by no means examined the rock carelessly, for he most minutely and correctly describes the character of the *fracture* of the rock, and I must confess, that the only character of the rock which led me to guess it was not hornblende, was its brittleness, while toughness is a characteristic of all hornblende rocks.

I was not aware when I pointed out the mistake about the rock, that Lieutenant Newbold has anticipated me in the remark. The Editor in his remarks affords an instance of the incorrect manner in which mineral names are sometimes applied. He remarks that the rock is plainly a species of steatite. Now, some of the characters of steatite are softness—is easily scratched, yields to the nail, feels greasy, is pulverized with difficulty, and contains little iron; while the rock in question possesses *opposite* characters to every one of those enumerated. Regarding the eurite, I must allow that I chose a bad example; but from the tenor of the former remarks, it will be easily seen that the point is not worth contending. In the third remark about the silicious schist, the Editor affords an opportunity of shewing the disadvantages of not defining mineralogical characters. Granite in India is often schistous; it is silicious, therefore it is silicious schist. If its granitic character is advanced, we will take the lamellar quartz rock of Norway, alluded to before. This then is a silicious schist. But, the being *silicious* cannot be considered a distinguishing character of any mineral; for there is hardly any rock which does not contain more silex than any thing else. Among the conflicting definitions of writers, it will be easily seen that the term silicious schist or flinty slate is intended to distinguish a tough and hard silicious variety of argillaceous slate, and therefore it will be a silicious schistous rock, containing alumina and iron, while hornstone is almost pure silex. The rock which Dr. Benza calls silicious schist, is almost pure silex, is not at all schistous, contains no iron, and no alumina, and instead of being dark coloured, Dr. Benza himself—Journal 12, page 20—compares it with the *eurite* of Pallicondah hill. The schistous character alluded to by the Editor in his remarks arises from the smallness of the specimen. The rock is massive, and in beds of irregular thickness embedded in friable gneiss, as Dr. Benza correctly describes them; but the masses are divided by a series of irregular joints, which sometimes meet at an angle of about 60 degrees, and it is the flat surfaces produced by these joints that have been mistaken for a schistous structure. This separation by joints, dividing the most friable rocks into flat surfaces, as smooth as if cut by a knife, the planes of which divisions are at irregular angles with each other, is a peculiarity in Indian rocks which I have neglected to allude to, and have not space to describe, but which I have never seen alluded to by observers.*

VI.—*Sixth Report of progress made in the Examination of the* MACKENZIE MSS., *with an Abstract Account of the Works examined.—By the Rev.* WILLIAM TAYLOR. *(Continued from last No.)*

A.—TAMIL.

a. Palm-leaf manuscripts.

1. *Brahmóttara-cándam*—the concluding section of the *Brahma-puranam*, No. 10—Countermark 16.

Invocation to gods, and poets. The subject of this *purana* was delivered by *Vyasa* to *Suta*, and by the latter to the *rishis* in the *Naimisara-vanam*. Some notice of that *vanam*. At the request of the *rishis* the said *Suta* narrated a variety of matters connected with the *Saiva* system. 1.—The five letters. These are a symbol of the deity; securing the greatest benefits from the repetition of the formule. Illustrated from the story of a king of *Mat'hura*. 2.—The excellency of *Saiva* shrines. Illustrated by the story of a king of *Ayodhya*, who was driven from his throne, and caused to become a *rácshasa*. The legend of *Gokernam* is included, as relating to that king, who went thither, and was there relieved of his *Brahma-hatti*, or afflictive visitation. 3.—The excellency of the *Siva-rátri*, or night of *Siva*. Illustrated by a story; the sequel being, that a *Brahman*-woman committed the heinous crime of killing a calf, and eating its flesh. Dying from the effects, she went to the lower world, and returning was born as a *Chandála*. In this state she suffered great distress from want of food, and going to *Gokernam*, when the place was visited by pilgrims at the festival of *Siva-rátri* she cried aloud for food. Some one put a *vilva* leaf into her hand, and bid her eat it. To her surprise an image appeared in her hand, which she worshipped; and, by the merit of this homage, on the *Siva-rátri* her form was changed, and she was taken to *Cailasa*. 4.—The virtue of paying homage to the emblem of *Siva*, on the *Siva-rátri*. Marvellous effects are related; such as a dog, killed at that time, being born as a king; a dove that had taken refuge in a fane, being killed by a vulture, at that time was re-born as a king's daughter. Other similar details. 5.—The excellency of the *Sani-pradosha*, or certain especial homage on Saturday, of only occasional recurrence. Illustrated by a story of *Chandra-sena*, king of Ougein, who was so exemplary in the worship of *Siva*, that his fame, as a devotee, spread to other countries, the kings of which considered that such a one could never be conquered by them; in consequence of which they cultivated friendly relations, and always took leave of him with great attention and deference. 6.—*Pradosha mahatmya*, the value of the first part of the night. A king assaulted by enemies left the act of homage half unperformed, and went forth against them. He was defeated: his wife fled, and was delivered of a child on the bank of a river. These, and following calamities, proceeded from the negligence of the said act of homage. 7.—The same subject continued. The aforesaid child recovered its father's kingdom, attended to all requisite duties, and conquered the kings of many other countries. 8.—The excellence of *Soma-varam*, or Monday. *Chitra Verma* had a daughter named *Simanti* born as the result of penance; but the astrologers declared that, at an early age, she would lose her husband by death, which took place. A visit to *Yama's* world; a return thence; and subsequent prosperity are contained in the legend. Its purpose is to enforce the value of homage paid on Mondays, at a shrine of *Siva*. 9.—A continuance of the same subject. Further illustration by a tale of a *Brahman* of the *Viderbha* country. He had two sons who went to the king of that country to seek a livelihood, when the said king pointed out to them *Simantri* a neighbouring queen of **Nigarsha-desam*, advising one of the two to put on woman's attire. They accordingly went, one being so disguised, but *Simantri*, discerning the fraud, pronounced the doom of always continuing in that way degraded. The other son returned; and the father becoming acquainted with what had occurred went to the king of *Viderbha-dêsam*, and reproached him for teaching such a fraud, who referred the matter to his counsellors. These taking into consideration that the *Brahman* had always been an exemplary worshipper of *Siva* on Mondays, advised him to perform special acts of homage, which he did, and by the favour of *Siva* had another son born to him, whence the efficacy of homage to *Siva* on Monday, is deduced by inference. 10.—The excellence of the *Siva-yogya* (or ascetic *Saiva*-devotion). A Brahman, being wealthy, allowed himself the use of animal food, and irregular intercourse, for which he was reproved, and set right by a *Siva-yogi* (or *Saiva* ascetic). At a subsequent period the Brahman dying became a fœtus in the womb of a queen; and great difficulty and agony occurring at the time of birth, the king and queen went out into a forest, or wilderness, where a dead child was born; but a *Siva-yogi*, coming by, put *Vib'huti* (or sacred ashes) on the child; which opened its eyes, and was delivered alive to the mother, who greatly rejoiced. The ascetic announced that the child would be a powerful king; and, wishing prosperity, departed. Hence the estimation in which a *Saiva* ascetic ought to be held is rendered apparent. 11.—The instruction of *Bhadrabahu*, the said child. It relates to the teaching of the child warlike exercises, and accomplishments. 12.—This section relates some exploits of the said young man, and his receiving instruction in some *mantras* from *Riskabha-yogi*. 13.—The marriage of *Bhadrabahu*. 14.—Has a reference to section 9, the said *Sumantri*, in another birth, being it seems the bride of *Bhadrabahu* in this one. 15.—The excellence of the *Vib'huti* or *Saiva* ashes. 16.—The mode of preparing those ashes, and of using them; whereby all sins are removed. 17.—The tale of a *Vedar* or savage hunter, who obtained beatification by the worship of *Siva*, whence the excellence of that worship is inferentially deduced. 18.—The section of *Uma isvara*. It refers to the death of a *Brahman*, by the bite of a serpent, and to certain directions given by a sage, as to the worship of the said form of *Siva* and *Parvati*. 19.—Story of *Surati* a *Brahman* female (on the principle of the metempsychosis) who was falsely accused, and delivered by the interposition of a celestial voice. Her discovery of her husband at *Gokernam*, at the *Siva-râtri* festival, and great happiness afterwards. 20.—Excellence of the *rudracsha* beads. A king obtained *Cailasa* by wearing them. The story of a monkey re-born as the son of a minister of state. 21.—The excellence of the *Rudra-mantra.* Illustrated by a story relative to *Cashmir.* 22.—The merit of hearing this *puranam.* The sins of such will be removed; they will obtain all that they desire; will escape from *Yama;* and obtain many other advantages. A description of the torments of *Yama's* world, is given, from the narrative of a *Pauranica-Brahman.* These punishments are of gross crimes; and the fear of that punishment is obviated by hearing this *puranam* recited.

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* See note at the end of this Journal.—EDITOR.

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* Sanscrit *Nishada*.

Remark.—It has more than once met my observation that degrading, and depraving, as is very much the tendency in all *Hindu* books, those of the *ultra-saiva* kind are peculiarly so. A very brief indication of the contents of the preceding manuscript is given; a full translation would illustrate the above remark; further detail on which point is needless. The book is complete; and very recent in appearance: it remains quite uninjured. It is stated to be a production of *Vara-tunga Rama Pandiyan;* to be understood of a poetical version, in Tamil, ascribed, or dedicated, to him. From that poetical version, this one in plain prose, was made by some writer unknown. The original Sanscrit is said to be the concluding book, or portion, of the *Brahma-puranam.*

Note.—It it entered in Des. Catal. vol. 1. p. 166. art. xi. as "a translation of a division of the *Skanda Purana.*" The like definition of two Sanscrit copies, bearing the same title is given at p. 51. The *Scanda puranam,* has much referred to it, generally, which is of doubtful origin.—I would not determine; but am told that the aforesaid M.S. is part of the *Brahma-puranam;* and the title which it bears within itself, as well as on the label, certainly implies the same.

2. *Tirupachur St'hala puranam,* legend of Tripassore, No. 39—Countermark 43.

This is a legend of a small fane, written in verse of the *Viruttam* kind, and consisting of 595 stanzas, divided into seventeen sections; each section containing a tale as usual; but not of any consequence. The situation is 32 miles W. of Madras. The outer-workmanship of the shrine, I have remarked to be superior, and with an appearance of some antiquity. There are also remains around the place, at some small distance, in a different style of architecture from any thing now customary. The fort caused this place to become of consequence in the modern wars, and convulsions, of the peninsula.

Note.—It is briefly entered in Des. Catal. vol. i. p. 173. art. 28.

3. *Nita Venpa*, a moral poem, No. 177—Countermark 192.

The *Venpa* is a stanza of peculiar, and elegant, structure. Out of one hundred of such stanzas, this manuscript contains seventy one. The following is a brief indication as to subject. Those who are great are to be cultivated, and honoured; by doing which advantages are acquired: the ignoble or the mean, are not to be attended to, as nothing can be obtained from them, but trifles, or degradation. Illustration; if any one look into the den of a lion he will get the ivory tusks of elephants; but if he search the den of a jackal, he will only find an ass's skin, or sheep's bones. Things even change their character according to usage; as an osier-bamboo may be wound into the structure of a kingly coronet; or, if left to grow old, may become a rope dancer's, or mountebank's pole.

NOTE.—The book appears a little old, and is slightly injured by insects; though not at present seriously.

It is entered in Des. Catal. vol. i. p. 231 art. 61.

4. *Niti Venpa* (no distinguishing mark or number).

This is another copy of the above work, on very ordinary palm-leaves, without covers, or other similar mark of belonging to the collection. It has a deficiency of fourteen stanzas, and by its assistance the chasm in the other copy may be partially, though not wholly, filled up. To edit the work satisfactorily a third copy would be required.

Nyána sampantar Puránam, or legend of *Sampantar*, No. 44—Countermark 88.

This production seems to have formed part of a larger book. The leaves are numbered from 150 to 256, and a single leaf, a fragment, of another subject, follows. The book contains 1253 stanzas, on the life and actions of *Sampantar*, the famous champion of the *Saivas* against the *Bauddhas* at Madura, in the time of king *Kúna Pandiyan*, afterwards named *Sundara Pandiyan*. The story has appeared in my abstract of the Madura *puranam*; and also in various preceding papers of these reports. It is needless therefore to enter on it again.

The manuscript is old; touched, to a trifling degree by insects, and otherwise injured rather more seriously by the breaking of a few leaves, by reason of decay.

NOTE.—It is entered in Des. Catal. vol. i. p. 203. art. 19.

6. *Niti Sára anubava trattu*, a moral poem, No. 179—Countermark 194.

This is a poem in the *Cavyam* metre, synonymous with hexameter, or heroic, measure. The general subjects are the following :—

1. The nature of mankind, or of the human species; describing their qualities, or dispositions; and the way in which they ought to walk, or to conduct themselves.

2. The way and power of virtue: time, fitness and circumstances are to be noted; and, according thereto help or beneficence, to be extended to others.

3. The nature of rectitude. If people during the whole of their life observe perfect rectitude their beatification will be assured.

4. The nature of iniquity, or the opposite of rectitude. If any one do not assist others, but rather do them harm; if any one bear false witness; if any one swear falsely to the hurt of others, such courses are the opposites of rectitude.

5. The conduct of a king. If a king do not molest his subjects, but hold an equitable sceptre, such a one will attain a high future reward.

6. The way of rectitude. A king must know the four modes of "concord, division, tribute, war;" and by means of them conduct the affairs of his kingdom.

7. The way of irregularity; some reasons are given to shew that a king ought not to associate with the bad, nor yet to molest the good: such associations, and such molestation being contrary to equity.

8. Upright and moral persons should zealously cultivate the favour of the one true God. The worship of images, or multiform gods, is throughout the work discouraged, and more or less distinctly reprobated.

9. The human body constitutionally or physically considered, with reference to its healthy state, tendency to morbid affections, or positive disease.

Note.—This manuscript is complete, and of recent copying; slightly touched by worms in one or two places; but not at present of consequence. The book seems to me rather special, and as I conjecture is the production of some of the *Jainas* of olden date. There are several such works which I have long wished to see well edited. In any such series, this poem should find a place.

It is entered in Des. Catal. vol. I p. 232. art. 63.

7. *Arangesvara Venpa*, No. 182—Countermark 199.

8. Same title, No. 184—Countermark 200.

9. Ibid, No. 185—Countermark 201.

This work contains a series of illustrations of the Cural of Tiruvalluvar. The plan made use of is to quote a sententious maxim from the *Cural;* and then to prove its accuracy, by an example taken from other works of reputation : the illustration is usually practical, being of the nature of a historical or biographical, incident. The tendency of such a plan is to engraft both moral remark, or precept, and practical illustration, on the memory. If well and impartially managed such a model might be followed in other languages.

No. 182 wants 22 leaves at the beginning, the stanzas, with their prose explanation are in regular order from the 23d stanza to the 56th, but the remainder is wanting. The last leaf is greatly damaged; the others in good preservation.

No. 184 contains 75 stanzas, complete from the beginning, and the writing is then discontinued; evidently from the copyist not finishing his work. The manuscript is of recent appearance; but has been a little injured by insects, especially at the beginning.

No. 185 is complete from the beginning down to the 58th stanza; the rest is wanting, owing to some leaves having been lost. It is uninjured by insects.

NOTE.—These copies are entered in the Des. Catal. vol. 1. p. 245. art. 68, according to that entery there should be two other copies. These I have sought for through the collection, without finding them.

10. *Tiruvannamali-koil-kyfeyat*, account of the fane at Trinomallee, No. 224—Countermark 60.

This brief manuscript, in the former portion, is merely an epitome of several sections of the *St'hala-puranam*; narrating the stories in a very compressed form; and having especial reference to the *ammen*-shrine, which commemorates the victory of *Durga* over *Maheshasura*. Further on, there is an account of the circumstance which led to the employment of a low class of fishermen, who annually ascend the hill to light the large column of combustible matter, prepared as a *homam*, or offering by fire. They were chosen to this office, from their great ignorance, and recklessness of character. A sort of trick is practised in the lighting the said column; so as to induce people, unacquainted with the secret, to consider it to be miraculous, because it always occurs instantaneously at the very moment when the lamps are lighted below, effected by contrivance through the said fishermen, and by signal. It is added afterwards that when *Vira Sambhuva rayer* ruled, the *Chola desam*, he enlarged the fane by various additions. About 700 years since a *Vallāla* king, said to have ruled over the *Tuluva* country, came hither, and felt a desire to live at the place; but as its sacredness forbad the doing so, he built a town at some distance, and resided there. A vile story follows of *Siva* appearing under the form of an old *Pandáram*, and acting a part very unworthy of a god; but the story, however debasing to the object of their worship seems very pleasing to his votaries, as it is found in at least three books with reference to different kings, or chiefs in various places. The *Vallāla* king afterwards accomplished great conquests. The *Rayer* dynasty subsequently made additions to this shrine. The Mahomedans, when they acquired power, manifested much complacency towards this shrine; and gave it some grants and immunities. The manuscript adds that the Honourable Company follow the like method of proceeding.

Note.—This document is complete. It is somewhat damaged by insects; but, as yet not seriously. There is nothing in the document of consequence; unless a complete exposure of the folly, and stupidity, as well as criminality, of idolatry be so considered. Appended is copy of an inscription taken from the wall of a building erected by *Vajranga Pandiyan*. It is dated Sal. Sac. 1283 (A. D. 1361), and commemorates the gift of some land to the place by *Cumara-Campanra-udiyar*, son of *Vira-Bukha-Campanra*, of the family of *Harihara-rayer*. (This *Campanra-udiyar* it will be remembered performed an office of consequence in expelling the first marauding inroad of Mahomedans from the extreme south. This inscription therefore is of some interest). The manuscript is in good preservation.

I do not find it entered in the Des. Catalogue, and it has not the usual marks of classification, though the other Nos. are not wanting.

10½ *Tiruvannamallai-guru-nama-sivayi kyfeat*, or account of *Nava-sivayi*, a *Brahman* of Trinomallee, No. 248—Countermark. 101.

This a production of the class of writing heretofore more than once adverted to, in which prose is mingled with verse; the former being, in this instance, little more than a vehicle for the latter. *Nam sivayi* is represented as uttering a long train of *venpas*, a sort of bri sonnets, if I may so render the term, expressive of some supposed e cellence of some particular portion of the fane, at Trinomalee, and t *ammen*, or goddess, pleased with the strain, uniformly grants every p of the requests which are made. The production exhibits the puerili of idolatry, to a striking degree. The intention, however, of the bo seems to be to magnify the said *Guru*, as one extraordinarily favoured the local *numina* of the shrine.

NOTE.—The document is complete in twenty palm-leaves, which a in moderately good preservation; though a little touched by insec Two leaves are appended, containing an account of succession by her ditary descent of a *Pandáram*, of the said fane of *Trinomali*: of importance.

The M.S. is entered in the Des. Catal. vol. 1. p. 207. art. 30.

11. *Tanjavur Cundiyur-Isvara koil-sila-sassanankal*, or inscriptio on stone in the *Saiva* fane of *Candiyur*, in the kingdom of Tanjore, N 5—Countermark 957, written within.

" The contents are thirty two inscriptions copied out in *Candiy Tirupanturatti*, *Coil patti-tillistanam*, *Caduvuzi*, *Carunta pattankudi*.'

According to the number of the leaves, there are 95 palm-leav wanting; though the number of inscriptions, that is 32, is complet answering to the above title, written within on a blank leaf in a differe hand-writting. It is therefore uncertain whether what may have pr ceded was taken away or lost; but some similar books in the collecti render it probable that this is one section of a continued series.

No. 41. In the *Saiva* fane at *Candeyur*, dated 17th year of the r of *Kó-raja-Cesava-Maharaja*, gift to a fane at *Satya-mangalam*.

No. 42. Dated in the 10th year of *Kopa-deva*; but the other wor and letters are so evidently incomplete, and disjointed, that the inscri tion could not have been legible on the stone.

No. 43. Dated in the 11th year of *Kó-raja Kesari*, the name *Tiru Candeyur* is legible; nothing else.

No. 44. Inscription on the shrine at *Tirupantirutti* of *Pushpavane vara-svami*; name of the goddess *Savuntira nayak ammen*.

Dated Sal. Sac. 1346, in *Crodhi* year: gift by *Vijaya rayen*, of the ra of *Harihara rayer* of a certain portion from the revenue arising fro cultivation.

No. 45. Dated in Sal. Sac. 1336, *Manmata* year. Gift of land to the same fane, by some head-men, apparently three in number.

No. 46. Dated in the 10th year of *Korasadaipan Chola dever*; but no intelligible sense can be made out.

No. 47. Dated in the 30th year of *Kiri Konda Chola-dever*; gift of various sundries for offerings or services to a fane; the name of which cannot be made out.

No. 48. Dated in the 20th year of *Kiri Konda Kopa-Kósiya pairam dever Cholan*: gift of land to maintain a constant light in a fane of *'Adi-chandesvara.*

No. 49. Dated in Sal. Sac. 1454, a string of titles without any proper name; that of *Varadapaiyar* of *Krishnapuram* occurs, but this is perhaps that of the local god: gift of a tax on cows.

Remark.—The foregoing is merely a specimen of the contents. They are so prevailingly illegible, from deficiency of letters, as to lead to the inference, either that the said letters were defaced on the stone, or else that the characters were not understood. Considerable pains were taken with this book; without adequate result. The oldest inscriptions appear to have no *Sacai* year stated; and where the *Sacai* year is mentioned, the date is comparatively modern.

The M.S. is entered in Des. Catal. vol. 2. p. 118. art. 5.

12. *Bomma nayak kaifeyat*, account of a Poligar, No. 200—Countermark 96.

13. Same title. " 221 " 86.

The first of these documents is in the hand-writing of *Subrahmanyan*, and the other in the hand-writing of *Srinivasaiyan*, both persons being retainers of the house of *Bomma nayak*, whose chief town is herein termed *Carisapattu-vára-púr*. The subject, and incidents, in both documents are very nearly the same; being an account of the lineage of *Bomma-nayak*. It does not date higher up than the period of *Visvanat'ha nayak* of Madura; among whose attendants the ancestor of this race was one. As the Madura ruler distrusted the people of the south he built a greatly enlarged fort; and one of the bastions was committed to the care of the said ancestor; on whom likewise was bestowed an extensive fief in land, in the neighbourhood of *Sivagangai* and Ramnad. The lineage is given, downwards; without the mention of any thing particular, until the war against Tanjore, and the capture of its capital. Subsequently the mention of marriages, and petty incidents, occur, relative to other chieftains, and especially those of Ramnad. One of this line went to Tanjore in the time of *Tuccoji*, and *Sarboji*, Mahratta rulers; and distinguished himself, much to their satisfaction, by killing a tiger in single combat. Afterwards the incidents relate to the strifes, and unsettled state of things, down to the assumption of power by the Nabob of Arcot The writers mention the existing chiefs, at the time when the documents were written; and state the desire then felt to obtain the patronage of the Honourable Company.

REMARK.—Both documents are brief, and complete. They would merit to be consulted in any particular account of the unsettled, and disorderly period of the Madura government, posterior to the contested succession by *Minacshi*, and *Bangaru Trimala nayak*. This house of *Bomma nayak* subsequently met with a severe fate, after giving much trouble. I am compelled to say I think they deserved it; for by traditionary circumstances, handed down in a portion of my family, I know them to have been among the worst of the *pálliya cárers* of their day. The incident connected with one of this race in the time of *Tirumala nayak*, has been before adverted to, in the abstract of the Madura *Virapan Ammāni* (see 4th Report).

NOTE.—One of these copies is entered in the Des. Catal. vol. 1. p. 206, art. xxv.

14. *Dirākaram*, a vocabulary, No. 64—Countermark 221.

The work which bears this title is a common and well known vocabulary of the Tamil language, in verse, on the plan of the *Amra cóshu*, and *Nigandu*; though not so full. It is ascribed to *Chendal Divákaran*, a follower of *Subrahmanya*.

Of the twelve parts of which this work, when complete, consists, there is in this manuscript only about two-thirds of the first part, on the names of the gods. As regards preservation, the fragment is uninjured.

This manuscript is entered in Des. Catal. vol. 1. p. 252, art. 7. Another palm-leaf copy is mentioned; not at present in the collection.

15. *Stotra agavel*; hymnology, No. 195—Countermark 178.

A few leaves without order, or connexion, and so greatly damaged by insects, and other causes, as to be no longer coherently legible. As far as any subjects can be made out, the contents agree with the title, indicating a poem of the easiest kind of metre, in praise of various so called deities.

It is entered in Des. Catal. vol. 1. p. 227, art. 42.

b. Manuscript books.

Manuscript book, No. 22.—Countermark 228.

Divákaram, a Tamil dictionary.

An incomplete palm-leaf copy is noticed in the preceding portion of this report. The present copy is complete, in twelve parts, it is written on strong Europe paper, with good ink, and is in perfect preservation.

Manuscript book, No. 10.—Countermark 67, *Calingatu Parani*, a poem on the conquest of *Calinga*.

This is a complete copy of the above mentioned poem; respecting which a notice from a palm-leaf M. S. was given in my fifth report. In this book the seven first sections are found, as therein stated; but the following portion is numbered on, as to verses, without break or division into sections, to the end; comprising in this last portion, three hundred and thirty stanzas, or nearly as much as the entire amount of the preceding seven sections. The palm-leaf copy appears to be the best one of the two.

Note.—This book is in good order, the ink only a little pale; but it needs no further attention. It is entered in Des. Catal. vol. 1. p. 196, art. 5, with regard to which entry it may be observed, that the leading fact of a *Chola* conquest of part of Telingana is beyond question historical; all the village records of the country containing references to it, in a way necessarily implying a foundation in fact.

Manuscript book, No. 22.—Countermark 776.

Section 1. Account of *Chitambaram*.

The paper has, in Telugu, the title of *Chitambara makatmya;* and is found to be another copy of that portion of the contents of M.S. book, No. 1. included under the title of the local *mahatmya* or legend. It adverts to several *rishis*, and to various matters relative to appearances of *Siva*, needless to be further particularized; seeing that the legend received full and particular attention in the abstract of the above-mentioned book in my third report.

Section 2. Tales of the four ministers of the king of *Alacápuri.*

A sufficient notice of these tales before occurred in my fourth report, from a palm-leaf manuscript.

Section 3. *Siva mata-sastra,* or the book of the *Saiva* sect.

Details of places where there are *Saiva* fanes, and mention of hierophants, and ascetics. The peculiarities of the *Saivas* are stated; as also the four distinctions under which they rank all votaries; together with notice of the rites, both simple and symbolical, which they are accustomed to perform, with regard to their emblematical figures, or images. A list is added of books, specially appertaining to the system of the *Saivas.*

REMARK.—This book, as to binding and paper, is in good preservation. The ink only is in some places faded. The latter part, so far as relates to the *Saiva* worship, is the only portion that could be considered of the slightest consequence.

Manuscript book, No. 20.—Countermark 260.

Cappal sastram, or art of navigation.

This book contains three subjects—the *Cappal-sástram*; the *Silpi-sastram*; the *pancha pacshi-sastram*: astrology predominates in the two former.

1. The *Cappal-sástram.* There are some directions concerning the mode of building ships, and the proper time of doing so. The suitable times for sailing are stated; the observation of the stars and lunar mansions is enforced with reference to every thing; even to the dropping of an anchor, which must be only as the stars ordain; and so for the remainder.

2. The *Silpi-sastram.* Directions for laying the foundations of houses, and other buildings, and raising the superstructure. Astrology is mingled up with the other matters; and in this art is evidently of commanding influence.

3. The *Pancha-pacshi-sastram.* This is a most fanciful system. Five different species of birds are arbitrarily nominated, and certain actions, such as sleeping, walking, &c. ascribed to them. Particular

divisions of the day and night are attributed to them; and as these follow in various alternation, so different actions of the birds correspond with different periods of the day and night. Some of these actions are fortunate; some the reverse: consequently it requires both labour and skill to discover what bird rules the hour, and whether the action of the bird at the time is propitious, or adverse. If adverse, nothing must be done just then. This artificial system, I have understood, is not generally received. One more preposterous it would be difficult to imagine. This last part is incomplete.

Remark.—The book is generally in good preservation, the ink a little pale, but at present nothing further is requisite than moderate care.

Manuscript book, No. 14.—Countermark 155.

Section 1.—*Paramart'ha Guru.*

A sarcastic series of tales by *Beschi*, levelled at heathen *gurus;* and intended, at the same time, to assist in learning familiar phrases in the Tamil language. It was translated by Mr. Babington. The above copy is complete.

Section 2.—*Agastya varalāru.*

An extract from the *Cāsi Cāndam* of the *Scanda puranam;* heretofore given in an abstract of that book. Vide 5th Report.

Section 3.—*Jati-vallamai.*

A tract on differences of caste, written by *Veda Nayak*, a Christian in Colonel Mackenzie's employ.

Section 4.—*Jāti béda nül.*

The poem of *Ulaga nát'ha*, heretofore noted (vide 4th report). The subject is, the differences, and distinctions, of castes, or tribes.

Remark.—The contents of this book are in very good preservation The different sections are entered, under distinct heads, in the Descriptive Catalogue.

B.—TELUGU.

a. Palm-leaf manuscripts.

1. *Vira bhadra vijayam*, or the triumph of *Virabhadra*, No. 69.—Countermark 321.

2. Another copy, No. 70.—Countermark 467.

Both of these manuscripts are complete copies of a poem in the *Padya-cávyam* measure, relative to the destruction of *Daesha's* sacrifice by *Vira Bhadra*, produced by the anger of *Siva* in consequence of the death of his wife. The narrative was heretofore given in the abstract of a part of the contents of the *Bhágavatam*, rendering enlargement needless; indeed the story is popularly well known. This work is the production of *Bommana-pota raja*, or more briefly *Potaiya*, an author of considerable eminence. Both copies are in good preservation. The manuscript No. 70, has the appearance of being the oldest of the two.

Note.—One copy is entered in Des. Catal. vol. 1. p. 348. art. 68.

3. *Ramabhyudaya*, or the fortunes of *Rama*, No. 98.—Countermark 292.

This poem in the *Padya-cavyam*, is by *Ramabhadra cavi* who, by one account, is said to have flourished in the reign of *Crishna rayer*. This poem was his principal work. It contains an abstract of the general subject of the *Rāmayana*. The lamentation of *Rama* on the loss of *Sita* is, by some, considered to excel in pathos. This copy is exceedingly imperfect; many palm-leaves being wanting. What remains is in good preservation.

Note.—It is entered in the Des. Catal. vol. 1. p. 334. art. 46; and is stated to be "by *Ramabhadra-kavi* of *Uttanutta*, dedicated to *Nrisinha raja* of *Gobur*." I do not know that there is any real discrepancy between the two accounts as to the author.

4. *Sri Calahastri-mahatyamu*, the legend of *Calahastri*, No. 76.—Countermark 22.

It is otherwise named *Yadava raya-charitra*. The contents are of the usual character, in such legends. *Siva* is said to have assumed the form of a *Jangama* ascetic, and to have related to a king of the *Ya-*

dava race, the origin of the image at this place; and the excellence of the shrine, as illustrated by various tales of devotees of *Siva*, who in consequence obtained union with his form, or beatification.

The book consists of a larger manuscript in the *Pádya-cávyam*, containing the legend which is complete; and of a smaller book containing a brief abstract in Telugu prose; being a summary of the contents of the poem. The whole is in good preservation.

Note.—The M.S. is entered in the Des. Catal. vol. 1. p. 277 art. 20.

5. *Vasu-charitra*, or tale of *Vasu*, No. 31.—Countermark 459.

This is a mere fragment of an elaborate and celebrated work, composed by *Bhatta Murti;* one of the eight celebrated poets at *Vijayanagarum*. It is in the *Padya-cávyam*; and is said to have been much admired, and made a model by later poets. It was written after the capture of *Vijayanagarum*, and under the patronage of *Timma raja* of *Pennaconda*, son of the ill-fated *Rama raja*, last of the *Vijayanagarum* dynasty, and elder brother of the two rulers at *Chandra giri* and Seringapatam. It should contain six *asvasas*, or sections; the genealogy of *Timma raja* being given at the commencement. The subject of the poem is a love-tale relative to *Vasa*, a king's son, and his marriage with *Giri-canyaca*, a mountain nymph, with the usual filling in of description, and metaphor.

At the beginning three leaves are broken in two, and the halves are lost, the 9th, 10th and 14th leaves are in the same condition. For the rest the first section is right. There is only about a quarter of the second section, and the entire remainder is wanting. The loss is not very material, as the poem is not scarce; but the passing off, this and many other fragments, on Colonel Mackenzie, as if complete manuscripts, certainly was a grave fault, on which it is superfluous to enlarge.

Note.—The book is entered in Des. Catal. vol. I. p. 341. art. 62, but without any note of deficiency; which moreover is not usually given in the Catalogue; from the compiler of which, the deficiencies in MSS. seem to have been concealed.

6. *Retta-Matam*, or system of *Retta*, No. 108.—Countermark 493.

7. Same title,.....................No. 109.—Countermark 495.

8. Ibid,.......................... .....No. 110.—Countermark 494.

One half of the first of these manuscripts consists of a fragment (of about 50, palm leaves) of the tale of *Svarochisa-manu*, by *Allasani*

Peddana, the famous Telugu poet (see the notice of that composition, 5th Report B. Telugu, No. 12). This fragment is old; has one or two leaves broken; and insects had begun to glue the leaves, preparatory to their work of destruction; but have been interrupted. It may be set aside previous to adverting to the other contents.

The *Retta-matam* properly consists of six sections, of which No. 108, contains five complete. It is old, two or three leaves are broken; others glued by insects; and a work of destruction was begun; though not carried on to any material extent. No. 109 has two leaves prefixed, containing praises of *Vishnu*, as *Ráma*; and there are five sections of the *Retta-matam* complete, with a few leaves of the sixth, but the remaining portion of that section is deficient. It is a comparatively recently written book: notwithstanding which, it has a leaf or two, broken, and others slightly punctured by insects. No. 110 is a small portable pocket sized book, containing selections from the astrological portions of the work, concerning eclipses, and the influences of "the nine planets." It seems to have been copied out only a few years since; and is in perfect preservation.

The introduction to the *Retta-matam*, contains some eulogy of *Vencata-rayen*, being the ruler of *Chandra-giri*; and younger brother of *Timma-raju*, of *Pennaconda*. *Ayalu-Bhascara*, being present in his court, was asked to narrate some poem, with which request he complied, by translating, from the *Hala Canada* language, the work of one named *Retta*: the leading topics of this translation are,

1. On the causes inducing the production of rain.
2. On discriminating the value of produce from the earth.
3. On divination, by signs, tokens, &c. on the *Hindu* system.
4. On augury, or divination by birds.
5. Concerning *Dhútas*, messengers, familiar spirits, or demons, supposed to reside, like hamadryads, in trees; sometimes in fanes, old houses, cross-roads, &c; and considered to have the power of speech, sometimes with visible appearance, sometimes without, and indicating good or evil to the human beings addressed. The agency of this class of supernatural machinery is frequently adverted to, in *Hindu* books.
6. Portents, or indication of clouds, as to rain.
7. Indication of rain by an aerial sound, preceding its fall (an observable phenomenon in heavy tropical rains).
8. On the qualities, or excellencies, of learning.
9. On the rainbow, or fabled bow of *Indra*.
10. On lunar haloes, as an indication of rain.
11. On the rising of the sun, and consequent effect on the wind.

12. On the origin, birth, or generation, of the human species.
13. On the pouring out, or oblation, of water, in ritual devotion.
14. On the effects, or influences, of eclipses.
15. On sudden, or unforeseen, events; especially sudden deaths.
16. On unpropitious events, or evil results, of planetary influence.
17. The nature of opposition of planets, and results.
18. The propitious result of favour from a spiritual preceptor.
19. The influences, or powers of different years of the *Hindu* cycle.
20. On good and bad days; or those propitious, or unpropitious.

These varied contents are distributed among the several sections; not regularly, but according to the extent or quantity: for example, one complete section is occupied with the subject of rain, while other sections contain several subjects.

REMARK.—Observations which I have elsewhere made as to Hindu astrology, apply I conceive, to this book, as well as to others at different times noted.

The three copies are entered in Des. Catal. vol. i. p. 356, article 1.

9. *Amukta-mála*, a poem, No. 25.—Countermark 340.

10. Another copy,........No. 26.—Countermark 341.

11. *Amukta-málu vyác'hyánam*, No. 27.—Countermark 342.

The two first manuscripts are copies of a very difficult poem by *Allasani Peddana*, which was written in the *padya cávyam* metre, and so abstruse that some say he himself wrote the prose explanation contained in No. 27, in order to render his poetry intelligible, even to other poets. In the early portion there is a reference to mythology of the *Vaishnava* kind, and to *pauranical* history. The lunar race is given, and by the medium of the *Tuluva* country the line of *Narasinha rayer*, and *Crishna rayer* is panegyrically narrated. The latter was the poet's patron, and has herein an epithet given him, as being the *Vira Bhadra*, who conquered the fort of *Condiviti*; also giving the credit of the work to him, by inserting his name as the author. It is then observed that the special object of the work is to narrate an account of the ascendancy of the *Vaishnava* system at *Sri-vili puttur*, in the ancient *Pandiya* country. A *Pandiyan* king of early times, being embarrassed on the subject of religious differences, assembled votaries, some of whom told him he ought to worship *Siva*, some said *Brahma*, some said *Agni*, some said *Vayu*; and so on. Thereupon *Vishnu-Sid-*

dhar, a Brahman of *Sri-vili puttur* publicly disputed in the king's presence, with the votaries of other systems; confuted them; carried off the prize which the king had appointed as the reward of the successful disputant; and converted the king to the *Vaishnava* faith: who consequently built shrines and fanes, especially at *Sri-vili puttúr*. At a later period one named *Yamanácharyar*, of the same place, in like manner overcame in a polemical discussion, and by the *Pándiya* king of the day was rewarded very munificently. The work then adverts to the history of *Crishna*, with a profusion of poetical ornament, concerning the *Gopis*; and expatiates on the excellence of his shrine at *Vili puttur*. A remarkable story occurs: a *rácshasa* (or savage) having caught a *dási*, or female slave of the fane, purposed to kill, and eat her (another trace of cannibalism in the South of India), to which the *dási* made up her mind; but begged permission first to relate some stories. She drew on her knowledge in order to narrate the Hindu account of the origin of the world, mythology, and the like; with such marked effect, that the barbarian renounced his anthropophagy; became a convert to the *Vaishnava* system, and had his "vile body" transformed into one resplendent with lustre. Subsequently the incarnation of *Ramanuja* is stated; together with his victories, as a champion of the ultra *Vaishnava* system.

NOTE.—The manuscript No. 25 is rather old; the palm-leaf No. 13 is broken in two, and one half lost: for the rest the copy is complete, and without damage. No. 26 is somewhat older in appearance than the other. The 42d leaf is broken in two, but neither half lost. The last two leaves are slightly touched by insects. The copy is in all other respects complete, and without injury.

The manuscript No. 27 has four blank leaves wanting, in the fifth section; forming a chasm in the subject: the remainder is complete.

The book is of recent appearance, slightly touched by insects in a few places; but, on the whole, in good order, and preservation.

The three copies are entered in the Des. Catal. vol. 1. p. 318. arts. 3 & 4.

12. *Crishna Arjuna Samvádam*, or the discussion between *Crishna* and *Arjuna*, No. 19.—Countermark 279.

A *Gandharbha* offended *Crishna*, then ruling in *Dwaraca*, whose court is described. *Crishna* being angry, and threatening the chorister's life, it mounted a flower, as a vehicle, and speeded to *Arjuna* for protection. *Arjuna* granted the boon. *Crishna* sent messages, demanding the restoration of his servant, which *Arjuna* pertinaciously refused. The consequence was entire disagreement; and preparations for war. All however ended peaceably; and on a good understanding being restored, the *Gandharbha* was allowed to proceed at pleasure, its life being spared.

NOTE.—The M.S. is old; a little injured at the outward edges; but not otherwise, and it is complete. It is written in the Canarese character; but the language is Telugu, in the *Pudya cávyam* metre. The copy has the appearance of having been made by a person unaccustomed to Canarese writing.

The work seems to be a mere play of the imagination.

It is entered in the Des. Catal. vol. 1. p. 270. art. 11.

13. *Panduranga mahatmya*, No. 39.—Countermark 287.

14. Same title, „ 40 „ 288.

This is a local legend of a fane, composed in the *Padaya cávyam* metre, by *Rama Crishna-cavi*, in the reign of *Sri-rangha-rayalu*, whose genealogy, as patron of the poet, is given. The *puranam* was declared by *Vyása*; by him communicated to *Suta-rishi*, who delivered it to *Savunaca-rishi*. It is divided into 5 sections.

The excellency of *Cási*. The *Brahmans*, and other sages, its buildings, people, and a variety of matters, descriptive of its splendour, and superiority.

2. Account of *Pandurangam*, narrated by *Siva*, to *Parvati*. In very early times *Pundarica*, for his exemplary virtues, was favoured with a visible appearance of *Vishnu*, as *Crishna*; and obtained from him special immunities, and privileges, for this shrine. Some details are given, respecting the different *tirt'has*, or sacred pools, for bathing at this place.

3. Concerning *Calinga-patnam*. Account of a *Brahman* of *Calinga*, whose manners and conduct were extremely bad; but who afterwards, by worshipping, and bathing, at this place, became entirely altered, and finally obtained beatification.

4. Concerning the *Pundarica tirt'ha*. The value of this particular pool, named after the founder of the shrine, and the efficacy of bathing therein, are illustrated by a variety of legendary anecdotes, or narratives, in the usual strain.

5. Narrated by *Sambhu-murti*, or *Siva* to *Náreda*. This section relates chiefly to *Crishna* and *Rucmeni*, and its being put into the mouth of *Siva*, is apparently designed to magnify the worship and sect of *Crishna*, to the depreciation of the rival system.

It is entered in Des. Catal. vol. 1. p. 384, art. 46.

Manuscript book, No. 6.—Countermark 899.

Section 1. Journal of *Nitala-narayan*, from February 1816, to Mar 1819, in Travancore.

This journal consists merely of tabular memoranda of towns and v lages, or observable places passed; and is a sort of itinerary addressed the writer's own recollection, without having been drawn out into fully written report. This state of the document may perhaps be counted for, by reason of his employer being called away to Calcutta 1819. I have usually passed by such reports. This one is of l worth than usual. It is written on China paper, which is uninjur and the ink will long continue legible.

Section 2. Account of ceremonial purifications, and other customs the *Smarta* Brahmans of *Kerala desam.*

This small and brief document, written on China paper in Telu characters, is in the Sanscrit language; and will be adverted to, in proper place.

Section 3. Account of *Sancarácharya*, and the *Namburi* Brahma

According to this document *Sancarácharya* was the illicit son o widow; born by reason of vows, made in jest, before a *Saiva* embl On his birth, his mother was excluded from her tribe, by the *Namb* Brahmans. The child made great progress in learning; and, travell to Conjeveram, there formed a shrine; from doing which he is her said to have derived his name. At a later period he laid down 64 ru for observance in the Malayalam country. Some rules were also p cribed by *Parasu Rama.* Copies of these rules, in their substance, given; they relate to many matters of daily intercourse, in life; an various ceremonial observances.

This document is written on China paper, but not injured; and ink will long continue legible. There are a few copies of short insc tions in Sanscrit *slocas*, not of great importance, but to be noted in ther place.

Manuscript book, No. 3.—Countermark 693.

The contents of the three first sections of this book, relate to e minor details, respecting sixteen villages; the whole occupying only a few octavo pages, and containing lists of villages, and matters therewith connected, of no consequence.

Section 4, being stated in the index to contain an account of *Budam*, a ruined city, attracted more special attention. On examination, it appears that the *Jainas* held an ascendancy, and built this town, in the *Repalli* district. But discussions arose between them and the Brahmans, which led to the persecution and punishment of the *Bauddhas* (which last term is also used). The town which they once inhabited, becoming depopulated, went to decay, and finally to ruin; and the ruins are stated to be extensive; while, according to common report, amidst the ruins there are buried images, and other remains, of the *Bauddha*, and *Jaina*, system of ritual worship.

Section 5. Relates to a village called *Buda-palli*; deriving its name also from a *Bauddhist* founder; but concerning which there is nothing particular, claiming special notice.

The remaining four sections are occupied with very brief accounts of twenty-two villages, and one *agraharam*, so minute and unimportant as to claim no further attention.

Remark.—The book is only an octavo, firmly bound; the ink good; the country paper in some places is a little damaged by worms; but all that is required to its effective preservation, is the being occasionally opened, and exposed to the air: the neglect of which precaution has given occasion to much of the damage sustained by the collection.

Manuscript book, No. 42.—Countermark 796.

The *St'hala mahatmya* of *Tirukola-kudi* fane, in the *Siva-gangai* district.

This paper, not noted in the table of contents, has been pasted into the book, and is contained on three pages of country paper.

At the request of *Agastya* and *Pulast'hya*, *Siva* usually resident on *Kailan-giri* (or *Cailasa*), came hither, and taught instructions conformable to the *Saiva* system; while seven *sactis* also became resident there, whence the fane is sometimes called by the name of *Siva*, sometimes by that of the *sactis* aforesaid. The legend is of no other use, than to add an item of evidence to the first planting of the *Saiva* system in the extreme south.

The remaining contents of the book are found to contain an account of the supercession of the old *Pandiyan* kingdom, in the time of *Chandra Sec'hara*, by the northern dynasty, of which *Visvanát'ha Nayak*, was the first; and coming, with considerable fulness of detail, down to the end of the reign of *Tirumala Nayak*. From this last mentioned circumstance; and from internal evidence, of style and manner, I perceive the document to be a first part of the narrative, of which a second part, and verbose continuation, down to the entire cessation of the dynasty, is contained in MS. book, No. 31—Countermark 785, and noticed in my first report (B. Telugu). A translation of this latter was published by me among annotations in the 2d vol. Or. Hist. MSS. I did not at the time know why the account therein commenced with the son of *Tirumala Nayak*; but the present document, now met with, explains the reason. The two parts being taken together constitute a complete history of the northern Madura dynasty; fuller in details than any other one, I have yet seen. This part ought also to be translated. This first portion is in much better preservation, than the second was heretofore found to be. Still as the China paper on which it is written is fragile, and the ink not good, its restoration has been judged suitable; since I regard the document as one of value.

I have examined it in various places, so as to satisfy myself concerning its contents, but the reign of *Pedda-Crishnapa-nayak*, successor of *Visvanat'ha-nayak*, was scrutinized with the most care, in reference to the war against *Tumbichi Nayak*, and with a view to see if it confirmed the statement in palm-leaf MS. No. 124 (see 3d report, B. Telugu 1), respecting an invasion of Ceylon, by that king. The account of that event is found herein; with two minor variations of some consequence. The invasion is attributed to a refusal by the *Singhala* king to send pearls and elephants; demanded by the Madura king, as a compensation in place of pecuniary tribute. Some difference is observable in the incidents of the war; and, especially at the close, the *Singhala* king instead of being killed in battle, is represented as conquered, and consenting to send the pearls and elephants, and thereupon having all his authority restored to him, and acknowledged. This attestation to the leading fact of an invasion of Ceylon, from Madura is of importance. There is also a repetition of the assertion in the aforementioned MS. that *Pedda Crishnapa Nayak*, exacted tribute from the Malayalam king. No external indications could have led me to expect any such document in this book; and the need of patient research in the documents of a collection, at first so loosely and carelessly thrown together, is the more apparent.

NOTE.—The table of contents, as entered at the head of the book, may be seen on reference to the Des. Catalogue vol. 2. p. 50, art. 42. According to that table there should be six sections, referring to Chittoor, to Vellore and Arcot, to Chingleput, to Sadras, to Gingee, and Trivalore, not a word* answering to which indications is to be found. The index must have been prepared for other matter; and the documents herein contained, put in perhaps at the discretion of a native *muchi*, or binder. However, now that the real contents are ascertained and appreciated, the mistake ceases to be of consequence.

Manuscript book, No. 32.—Countermark 722.

Appended to the full, and interesting, account of the princes of Warankal, abstracted in my last report, is a paper concerning *Calyanapatnam*, then adverted to, and deferred until the palm-leaf MS. No. 128, *Basavanna Calagnána*, had been examined. Though both relate to the *Vira Saiva* sect, and to *Bassavanna*, as one of its distinguished promoters, yet the subjects of the two works differ. This appendix is therefore here resumed.

It is entitled an account of the minister of *Vijala raja*, who ruled in the town of *Kalyána.*

The elder and younger *Basavésudu* were the founders, or revivers, of the *Jangama* sect. *Pedda tanda Basava*, the elder, is stated to have been an incarnation of *Nandi*, the bullock-vehicle of *Siva;* sent down, by an agreement between *Siva* and *Parvati*, to restore and spread the *Vira-Saiva* system. *Chena Basava* was his sister's son, or his nephew. Various narratives are introduced, and among them that of *Kuna Pandiyen*, who destroyed the *Samunas* at Madura; and is, in consequence numbered among the *Jangama* votaries, by themselves. The great topic is the overthrow and extermination of the *Jainas*, which every where seems to have been accomplished by means of ultra *Saivas*. The precise locality of *Kalyanapur* is doubtful; but it was in the north-west part of the peninsula, where the *Jaina* system, under various rulers, greatly prevailed. The two *Basavas* every where exterminated the *Jainas;* and, at length, effected the death of *Vijala-raja*, their master, who was a *Jaina*. On this subject there is prospectively much to come. The present document is therefore now dismissed; with the sole further remark, that it is in very good preservation.

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* Since the above was written I have discovered that the index, proper to No. 41 was bound up in this book, and *vicé versa*.

Manuscript book, No. 28.—Countermark 218.

The contents of this octavo volume, relate to forty-six villages, *in* Telingana proper; the contents of each section being very brief; and after the investigation made with reference to other villages, *in* the same general locality, not offering any thing of leading importance. The 36th section has a notice of the tribe of weavers, in that country; of course of no material consequence.

This book as to paper, is in extremely good preservation. The ink is black and indelible. The cover is loose, at the back, through careless binding; but, with ordinary care, the document may be preserved many years.

Manuscript book, No. 29.—Countermark 719.

This book, of like size with the preceding, relates to the same general neighbourhood, and contains details of thirty villages, and *agrahárams*, or Brahmanical residences, the latter granted by *Mukant'hi* chiefs. Binding excepted, the whole is in good preservation, and much on a par, in all respects, with the preceding volume.

Manuscript book, No. 30.—Countermark 720.

This is a very thin quarto volume, and contains accounts of ten vil[illegible] lages, somewhat more full than the preceding; but not claiming minut[illegible] abstract. These villages are situated in, and near, the *Chintapalli* di[illegible] trict.

The paper on which this book is written is thin, and inferior to th[illegible] of the two foregoing ones. It has been in some places perforated [illegible] insects; but not to any serious extent. The ink is good; the bindi[illegible] loose at the back; but the whole will last long, with only common ca[illegible] the contents are not of much interest, or consequence.

Manuscript book, No. 2.—Countermark 340, *Bhadra-parinayam*, [illegible] epithalamium.

A poem in three sections by *Peddanácharya*, relative to one of [illegible] eight principal consorts of *Crishna*; demanding of course no spe[illegible] attention. Some little damage by worms being excepted, it is in go[illegible] preservation.

NOTE.—It is entered in Des. Catal. vol. 1. p. 320. art. 8.

Manuscript book, No. 29.—Countermark 312, *Pratapa-Cheritra*, or *Kakatiya vamsavati.*

This production is a poetical account of the *Ganapati* kings of *Warankal.* It is composed in the *dwi-pada* measure. The general subject is the same as that of MS. book, No. 32; of which a lengthened abstract was heretofore given. The only difference is that this is more ornamented, as being in verse, the substance in both is the same. There is a Sanscrit poem by *Vidyanāt'ha*, entitled *Pratapa-rudrayam*, of which this present production may be a Telugu version; but not having the composition of *Vidyanāt'ha* in possession, I can only offer a conjecture. The work under notice has within itself an indication to the effect, that it was produced by the united efforts of three sons of *Casamalaiya*, a *Brahman*, of the *Atri gotra*, or tribe of *Atri.* The book is in excellent preservation.

C.—MAHRATTI.

Manuscript book, No. 3.—Countermark 889.

Section 1.—Legendary account of the fane of *Varada-nāt'ha*, and of the *Sunda* river.

Legendary and *pauranical* reference. When *Siva* and *Parvati* were on *Cailasa*-mountain, *Nareda* came and represented that since *Brahma* had five heads, he was by reason thereof very proud. To lower his consequence *Paremesvarer* cut off one of his heads; and then, in order to expiate this crime, he wandered about for twelve years as a mendicant, asking alms. He did penance at this above-mentioned, place. *Narayana-murti*, knowing this circumstance, came hither; and taking up some water from a pond, with the ordinary drinking vessel made use of by *Brahma*, he with it, poured water over the head of *Siva*, and by doing so removed the guilt of his crime. By virtue of the touch of the said vessel the pond became a river. Hence all who bathe in that river, will, by doing so, wash away all guilt, or defilement whatsoever.

2d, *adhyayam.* Several persons, came hither, and formed in all twenty-four *tirt'has* or pools, the names and virtues of which, are specified. Among them are the names of *Brahma*, *Vishnu*, *Siva*, *Indra*, *Agni*, *Cubera*, *Isani*, and others.

3d, *adhayayam.* A *Brahman*, to whom the titular name of "hearing the *Vedas*" is given, came hither, and by bathing evening and morning in the different pools, was favoured with special visions of the deities, whose names they respectively bear, and obtained beatification. *Vishnu* after bathing in all these pools, went and succeeded in destroying the *racshasa*, named *Saugata-rana*. In the war between the *devas* and *daityas*, many of the latter, by bathing here, obtained beatification. The entire three hundred and thirty millions of celestials bathed here. Near to the river is a fane called, *Varada-nat'ha-cshetram*.

Remark.—Local mythology apart, the only point of notice is, that *Vishnu's* destroying the above-mentioned *răcshasa*, seems to be a symbol of the ever recurring subject—the triumph of Hinduism over the *Bauddhas*; the term *Saugata* being somewhat synonymous with Giaour, or infidel.

Section 2. Account of *Mayura-Verma*, a king of the *Cadamba* dynasty.

1. The account is put into the mouth of *Suta-rishi*, as related to a *Brahman*. The destruction of the *Cshetriyas* by *Parasu Rama*; his disgust with the *Brahmans*, and retiring to a hermitage: several *rishis* followed; and, looking on the western sea, advised him to reclaim land from it. The sea-king promised to render to him land, as far as he could cast an arrow. He thus reclaimed a tract of land of three *yojanas* (30 + miles) in breadth westward; and in length, from *Nisica* to *Canya-Cumari* 300 *yojanas*. Southward, or + 3000 miles. He located *Brahmans* therein, turning the *Boyi-jati* into *Brahmans*; settling one thousand of them there; and appointing to them lands for their support. He told them that if they had any cause of sorrow, or regret, they might think on him, and he would appear. He then retired to the fane at *Gokernam*. The said *Brahmans*, to test his veracity, recalled him, without cause; whereupon, being angry, he condemned them to lose the power of assembling together in council; and to become servile. They accordingly mingled with *Sudra* females; and became a degraded race.

About this time one named *Mayura-verma*, considering those *Brahmans* to be contemptible, sent for others from *Hai-Cshetram*, and located them at different places in his dominions.

2. *Sona muc'hi* enquires of *Nareda*, why *Mayura-verma* so located the *Brahmans*, and whose son he was. In reply a legend is stated to the effect that *Siva* and *Parvati*, on *Cailasa*, agreed to come down, and look at this newly formed country. In consequence of their doing so, an infant was afterwards found under a *Cadamba* tree, in the wilderness; to whom the epithet of *Cadamba* was therefore applied. It happened that the *Malata* country being without ruler, the people placed

a pot of water in the trunk of an elephant, agreeing to elect the person on whom it should be effused. The elephant went to the *Cadamba* wilderness, and poured it over the head of the young man there, who was proclaimed king of that country, and also of *Caurashtara** *desam*. He went to the *Kerala-desam*, to perform homage; and, at a shrine there, was confirmed in possession of the kingdom. He was married, and his son was *Mayura-verma*. He complained of the degeneration of the country-*Brahmans*, and invited others to come and purify his country. A few other particulars are added, as to the location of the colonist *Brahmans*.

Remark.—This section, being rectified from its legendary admixture, is of value.

Section 3. Account of *Srinivasa* fane, in the village of *Balamuri*, in *Canara*.

Bhishacācharya relates the excellency of the *Caveri* river. It is presumed that here *Caveri* (like *Ganga*), is used generically for a river. The purport of the paper, written partly in Balbund, partly in Mahratta letters is legendary, intended to account for the homage of *Vishnu* under the name of *Srinivasa*, as the lord of *Lacshmi*. Mythology excepted, there seems to be nothing of consequence, in this section.

General Remark.—This book is injured in the binding, but the country paper within is but slightly perforated by insects, the ink indelible. It may therefore pass, as not requiring, for the present, any further attention.

Manuscript book, No. 4.—Countermark 916.

Section 1. On the war of *Sālivāhana* against *Vicramaditya*.

In this section the usual enigmatical account of the birth of *Sālivāhana* is given; his mother herein being described as the daughter of *Bhascara*, a *Brahman*. The difference from other accounts is that, after the battle, *Vicramaditya*, having survived, sent messengers to treat with *Sālivāhana*, and agreed to pay tribute, on condition that each should rule on either bank of the *Nerbudda* river; that is *Vicramaditya* to the north, and *Sālivāhana* to the south. In another *Mahratta* document heretofore abstracted, such a division of one kingdom into northern and southern was mentioned, with some details of posterity on either side; and there really may be truth in such a simple statement, respecting a remote period, greatly mystified by *Hindu* writers. As to *Sālivāhana*, having for father a *naga*, or snake, it is mere symbol. The illegitimate son of *Kulottunga* named *Adondai*, the conqueror of the *Curumbars* is, in several Tamil manuscripts, said to be the son of a *Naga canya*, or female-serpent, which plainer books tell us means a female slave, or dancing girl, of *Kulottunga Chola's* court. To build any wild deductions on such figurative terms in *Hindu* writings is nonsense. The *Brahmans* have their "slang" language, just as much as the gipsies, or the jockeys of Newmarket. To get at their meaning, where they purposely conceal it, is the problem. Colonel Mackenzie seems to have had a hint given him; since he has written in pencil on the document, "A tantrum, or specimen of fabulous history." A *tantra* no doubt it is; and the meaning seems to be that the glorious *Vicramaditya* was beaten by the son of a slave, or wild forester.

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* By a modern corruption, Gujerat.

At the end of the document, it is stated to have been expressly compiled from other books by *Sri-pati-rao*, and *Chimmanaji-appa*, in November 1805, at Ahmednugger.

Section 2. In the injury to which the book has been exposed, this section appears to have been lost.

Section 3. Account of *Damaji Pant*, a person remarkable among the *Vaishnavas*

About 700 years ago, one *Damaji* was employed as a gomasteh, or factor, at the court of the Delhi-Padshah; and, as a reward for the skill which he displayed, a small district was made over to him, as a zemindary, subject to a tax. On going to his district, *Damaji* greatly abounded in liberality to *Vaishnava Brahmans*, multitudes of whom in consequence resorted to him; and could not be refused. The result was that *Damaji's* tax ran on in arrears; until, at length he was compelled to write to the Padshah, and explain his insolvent situation. The Padshah sent officers to take him; put him in fetters; and bring him to Delhi. But the deity at *Panrapur* (or Panderpore), hearing the misfortune of his votary, represented the case to *Rucmeni*, his spouse, and borrowed from her, all her golden, and jewelled, ornaments. Assuming then the appearance of a relative of *Dámaji*, the said *Crishna* went to the presence of the Padshah; offered payment of *Damaji Pant's* arrears; and demanded a receipt, and full acquittal. The Padshah was so struck with the surpassing beauty of the messenger's countenance, that for a time he was unable to give orders; but at length he directed the requisite documents to be made out; and on signing them sent word to *Damaji*, that he wished again to see the messenger. When the message, and acquittal reached the insolvent, he was much embarrassed; until, pondering over all the circumstances, he discovered that it was a manifestation of the *numen*, whom he worshipped at *Panripur*, that had interposed in his behalf. He then vowed a pilgrimage to that shrine; and, as the document says, the Padshah went with him: they together bathed in the *Chandra bhaga* pool, at *Panderpore*. This account was expressly written for Colonel Mackenzie, by *Shani-rao*, on the 24th December 1805, at Ahmednugger.

Section 4. Account of *Prasanna-Prabhu.*

This is merely an inane legend concerning a devotee of modern time; written to satisfy the curiosity of Colonel Mackenzie: but apparently not of the slightest value. The person referred to, had signalized himself by devoteeism of surpassing character.

There follows a tale, or fable of an ape and an alligator; taken from the later portion of the *Pancha-tantra* tales, as narrated by *Vishnu Sarman*; of course not relevant to the present enquiry.

REMARK.—According to the table of contents, prefixed to this book, there ought to be in all eleven sections; but all the matter now found in it is specified in the foregoing notice. The binding is broken; part of the book appears to be lost; and what remains has the margins, and some part of the writing, devoured by termites; their mode of doing mischief being easily distinguished from that effected by worms. A sufficient notice of the contents has been given. The account of *Vicramaditya* and *Sālivāhana,* is like other narratives, save the difference already indicated. The whole of the lengthened document, I do not think worthy of restoration; and all besides, is quite worthless. The book is passed without further attention.

Manuscript book (without mark or number).

In this book a quantity of loose leaves, containing Mahratta and Camarese papers, appears, to have been put in at random; possibly because, having been scattered, their order was unknown. On looking at the contents of the Mahratti, it appears that some part of the pages should belong to the foregoing book, No. 4. These relate to some *Hindu* auxiliaries of the Mahrattas, and legendary miscellaneous topics; and some part relates to contents of MS. book, No. 35 (Des. Catal. vol. 2. p. 116), in those sections that refer to the *Bala Rāmayana*, to *Bhoja raja*, and to the birth of *Sita*.

It is not now possible to extract order out of so much confusion. Happily the contents of the papers, so disarranged, do not seem to be of consequence. A perusal leaves the impression, that every thing material, in reference to the Mahrattas, is found in other documents; and as to the legendary, or mythological, matter this need excite very little regret: the quantity of details, on such subjects, being superabundant.

A few other loose sheets not included in this book, or any other one, are found on examination to be wholly legendary, and worthless. Not knowing any better place for them, they are put along with the other loose papers, in this book; and the whole must be passed, as incapable of receiving orderly, and complete adjustment; at the sametime not meriting restoration; even supposing it could be successfully effected.

Manuscript book, No. 34.—Countermark 784.

Section 1. Account of the allowances of the fane at Madura.

Such is the section heading prefixed, and also entered in the Des. Catal. The real contents are very rough and loose memoranda, concerning allowances to the fane at Tripety, of grants made by *Chola* and other *rajas*, and of the expenses of processions, or other festivals.

Section 2. Account of allowances to the shrine *Minacshi-amman*, at Madura.

This document relates to the said *Saiva* fane; containing as in the former paper, rough memoranda of grants, by various *Pandiyan* kings; and accounts of expenses at different festivals, and processions.

Section 3. Account of the allowances to the fane of *Alagiri*.

This section relates to a place of celebrity, about ten miles from Madura, situated on a hill; the image on which once a year pays a visit to the *Vaigai* river, in public procession. The memoranda of grants, and expenses, are similar to the preceding.

Section 4. An account of Mahomedan affairs in the Madura district.

This is a more connected statement, chiefly referring to revenue arrangements, and *jaghirs* from the Mahomedans.

Section 5. Account of *Indra* and *Nahusha raja.*

This is the legend taken from an older *purana,* with which the Madura *St'hala puranam* is made to begin: needless to be further detailed.

Section 6. Narrative of *Lava* and *Cusa.* Some particulars concerning the two sons of *Rama* of *Ayodhya;* of no special consequence.

NOTE.—The book on the outside is labelled "Tamil kyfeats," as pertaining to a locality where the Tamil language is spoken; and is found entered in the Des. Catal. vol. I. p. 68, art. 34. among Tamil documents. The language is however Mahratti, throughout; and this circumstance, I presume, arises from Mahratta accountants being employed at Tanjore, and latterly also at Madura. Hence I suppose these papers to have been, in part, extracted from cutcherry-papers: the entire control of festivals, and of allowances to them, being vested in the Principal Collector of the district.

The document is in very good preservation; and can at any time be consulted if necessary.

Manuscript book, No 39.—Countermark 947, account of the capital of Arcot.

There is, at the opening of this document, some matter which appears to be taken from Ferishta, concerning the origin of the dynasty of Timur Shah. The reign of some of his descendants is adverted to, and then a transit is made to the conquest of the Carnatic by Alemguir; and to the Mahomedan ascendancy. Thenceforward there is an account of the government, and fluctuations of power, at Arcot; with references to Hyder Ali, Tippoo Sultan, and finally to the English.

REMARK.—This document, in the latter part, may be of some value. It is in moderately good preservation; though in some places a little injured by insects.

It is entered, among Tamil papers in Des. Catal. vol. 1. p. 50, art. 39.

Manuscript book (on the cover, and first page, No 51—Countermark 468. *Bhairaves-vara Cadha,* &c. on the contents 25), tales of the *Betala* and *Vicramaditya.*

This Mahratta version of these tales is damaged; and, having been loosened from its proper cover, seems to have been put at random into the covers of a book, the contents of which should be Canarese, with reference to the *Vira Saiva* sect; or the persecuting, and exterminating, class of *Hindus*. Where the said matter in Canarese is, I know not. With the discrimination given, this book must pass as it is. It requires no further notice.

In the Des. Catal. vol. 2. p. 115. the entry occurs; art. 25. "Thirty-two stories of *Vikrama-raja*," and denotes, I presume, the book as it originally was among Mahratta documents.

Manuscript book, No. 5.—Countermark 650.

Pandu-rangha Mahatmyam, legend of the fane at *Panderpur*.

This book is written in Balbund characters, and is an incomplete copy, or rather a fragment of the legend in question. There being a better copy in Telugu, before abstracted, this book requires no further notice. It is in moderately good preservation.

D.—MALAYALAM.

It was heretofore stated that, to the best of my knowledge, all the Malayalam MSS. had been attended to; but, on the remainder of the collection coming more completely under my inspection, two palm-leaf MSS. in Malayalam were met with, among the Tamil documents, and one amidst the Telugu palm-leaf manuscripts; with some portions in Malayalam, mingled with Tamil and Telugu, in manuscript books. The following notice relates to these different documents.

1. *Kerala Ulpatti*, an account of Malayalam, No. 3.—Countermark 632.

This is a complete copy of the *Kerala Ulpatti*, on palm-leaves; agreeing with the copy which was before noted from a manuscript book. One leaf which was broken has been restored. The remainder is in good order..

Appended is the tale of *Sacara*, being I perceive, in all probability, the original of the Tamil MS. entitled *Sacara-cadha*, abstracted at the commencement of my third report. This document has the beginning, and is in regular order to the 25th leaf, but the remainder is wanting. This fragment is slightly touched by insects, but upon the whole is in good order.

2. Fragment of the *Kerala Ulpatti*.

This document was without label, number or any other of the usual marks of these manuscripts. On examination it was found to be an unconnected part of the *Kerala Ulpatti*, in that portion which, relates to the *Art'ha-Brahmans*, or the fishermen turned into Brahmans by *Parasu Rama.* There are only seven leaves, which are on the said topic, but without any proper close; being consequently incomplete.

3. *Kerala-Crisha-gita*, No. 1.—Countermark 633.

This is a poem on agriculture: a species of native Georgics. A manuscript copy was before noticed, and abstracted (vide 2d Report, book No. 3, sect. 3).

This manuscript was met with among the Telugu books; and, by consequence, escaped an early notice.

It is small; written on talipat leaves; complete; and in good preservation.

It is entered in Des. Catal. vol. 2, p. 95. art. 2.

Manuscript books.

Manuscript book, No 13.—Countermark obliterated.

The first, and largest, part of this book consists of Tamil papers, relative to the Malayalam country, of very little consequence: they are adverted to, and in part abstracted in my fifth report, under the head of Tamil documents. A few loose papers in the Malayalam language were unexpectedly met with, at the close; of which the following is a notice.

1. Two loose leaves, the first containing Sanscrit law *slocas*, with a Malayalam interpretation.

2. (Sec. 46, of the book). An account of the *Māpillais*, or Mahomedans, of *Ponani.*

States their having been brought from Mecca, by *Cheruman Perumal*, and located in this country; conformably to notices in preceding papers.

3. An inquiry into the difference between two tribes of military people, termed *Cola surupam* and *Tripal surupam*, made by judge Baber, with the replies in the shape of question and answer. The difference seems to have been thought of importance, as depositions were taken on oath, in the presence of an idol. The answers appear to be inane; at all events, of little or no consequence, in the present researches.

4. Enquires as to right of inheritance; which, in the Malayalam country, is not in children of direct descent, but only to sister's children.

5. An enquiry from the provincial court answered by two *Nambúris*, and one *Potuval*, as to the legality of selling the house of a

debtor for the advantage of creditors; without the consent of tl tor's proximate relations. The answer states, that entailed prope not be so seized and sold; but any house previously purchased debtor, on his own account, may be so available.

6. Relates entirely to law, in matters of theft; resolved b from Sanscrit authorities.

REMARK.—It will thus appear that the Malayalam portion book is not relevant to the object of the present investigation. A the several papers are but in an indifferent state of preservatior does not seem to be of consequence to re-copy them. The enti like many others, yields a specimen of negligent service, by *ployés* of the late Colonel Mackenzie.

E.—PALI. (As supposed).

Uttara Vadakan, No. 10.

This book, with the following one, are exceptions to the appearance and contents of the collection. This one contains 4 though short, talipat leaves; old in appearance; but in good tion. The character seems to me, to be, the *Pāli* of Ceylon; l not go beyond conjecture, as I have never seen any other than cular Ceylon *Pāli*, and the square *Pāli* of the *Barma* country. has strong covers of a fine grained wood, resembling mahoga if I mistake not, has written within side one of them the name clair, July 1818;" together with a little, from which I have the one above given. I regret that I have not the means of a ing the contents.

Mantras, No. 14.

This is a miniature manual, on small talipat leaves, mucl away at the edges; old in appearance; and in rude writing. racters, as above; but not so well defined. The covers have polish, and inside one of them is written. " Muntrum J. Sin 1818." Perhaps both books were obtained in Java, at its capi that as it may, I think both were originally written, or copied, i Should any *Pāli* scholar, at any time, inspect the collection, i that a glance would suffice to determine, both the nature, and the matter included.

F.—PRACRIT.

Palm-leaf manuscript, No. 62.—Countermark 140.

Mairavana Cheritra (*Grant'ha* characters), stated in the commencement to be taken from the *Jaimini Bhárata.*

1. *Adhyáyam.* Description of a fictitious town, with its various kinds of inhabitants.

2. Reference to the court of *Ráma,* the visit of *rishis* to him. His enquiries; and their congratulations.

3. Reference to the valour of *Hanuman.* The eulogy pronounced on him by *Agastya,* who narrates the tale. The sorrow of *Rávana,* in his palace, at his defeat; and complaint thereon to the inhabitants. In consequence *Mairavana,* a *racshasa,* came to console him, and to point out a scheme of revenge.

4. *Rávana* asks what can be done, not against men, but gods. *Mairavana* engages to go down to his kingdom, the inferior world, and offer a sacrifice to the evil goddess there. The wife of *Mairavana* dissuades him from any enterprize; since it must issue in his destruction. He then applies for counsel to his ministers; being still in his kingdom in the lower world.

5. *Mairavana* sets out at the head of his army, from the inferior world determined to make war. On the way evil omens appear.

6. *Vibúshana,* younger brother of *Rávana,* knowing all the preparations, which were being made, informed *Hanuman* and *Sugriva. Rama* (as *Vishnu*), was then sleeping, and could not be disturbed.

7. *Hanuman* assumed a supernatural form; and bound his tail all around the fortress, or camp of *Rama,* from the heavens down to the lower regions. He allowed only one entrance, at which he kept guard; and despatching *Vibúshana* as a scout, he gave charge of the interior to *Sugriva,* and others. It was now night.

8. *Mairavana* sent a spy who reported the preparations made; adding that *Vibúshana* only was outside, whose form thereupon *Mairavana* assumed, and going to *Hanuman,* told him to be on his guard: being allowed to enter the fortress, he took *Rama,* and his brother *Lacshmana,* both being asleep, and putting them into a box carried them down to his inferior world. *Vibúshana* was warned by evil omens; and returning, to see the cause, the deception was discovered. *Hanuman* enquired for directions; and, guided by a particular flower tree, came to the

entrance of the descent to the inferior world. Thither he went with troops, his proceedings, and the battles which followed, are detailed. It was not possible to kill *Mairavana*: he was cut into pieces; but the parts of his body came together again. All attempts to put him to death failed; until a relative pointed out that his life was in a certain cave, in the form of bees. These were killed by *Hanuman*, and *Mairavana* expired. The victor then placed the relative of *Mairavana*, who had given the information, in possession of the kingdom of the inferior regions, and took *Rama* and *Lacshmana* (both still asleep in the box, and knowing nothing of the matter), back to their proper place. *Agastya* narrated this tale to *Rama* in praise of *Hanuman*. *Rama* was greatly pleased; and showered down benefits on his successful protector. The whole time of the action of the poem was a single night.

NOTE.—The manuscript is complete, a little injured by insects, but not seriously. It is entered in Des. Catal. vol. 1. p. 97, art. 9.

There are some resemblances in this poem to others* of European production, which are to me rather surprising. Apart from which reflexion is the obvious remark, how lightly the *Hindu* votaries make of their idol gods, as occasion serves.

Manuscript book, No. 47.—Countermark 606.

Sanatcumara-silpi-sastra.

This little book is Sanscrit, in the Canarese character. It states that whereas several persons, in preceding times had written on the subject of architecture and sculpture, the author named *Sanatcumara*, having studied the whole of them, and having adopted from them, what appeared valuable, wrote down the results in this compilation. A detail is then given of the consequences that will follow from undertaking any work, in the various months of the year, some being propitious, and some otherwise. The effects of beginning to construct any edifice, under the different *nacshetras*, or 28 divisions of the lunar path. Different colours of soils adopted to the four leading divisions among Hindus. Matters such as these fill the document; not pertaining to the practical, or scientific parts of sculpture or building; but to astrological, and other indications; calculated, in the judgment of the writer, to guard against evil, and secure the greatest amount of benefit.

NOTE.—The book is in good preservation; but is incomplete. It is entered in Des. Catal. vol. 2. p. 63, art. 14.

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* I allude to a passage of the *Æneid*, and to another in Milton's principal poem.

Manuscript book, No. 6.—Countermark 899.

Section 1. Containing rough notes of an itinerary, by *Nitala narayan*, was noticed under the head of Telugu manuscript books.

Section 2. *Parasu-Rama-mahatmyam*, taken from the *Brahmandam-puranam.*

This paper does not seem to be entered in the table of contents. It is a document of octavo size, written on China-paper in Telugu characters, but the language is Sanscrit. It is divided into two sections.

1. The early life of *Parasu-Rama.* The quarrel of his father with the *Csketriyas.* The slaughter of the *Csketriyas.* His proceeding to the west; and there obtaining from the sea-king and goddess of the sea, as much land, as he could cover by the flight of an arrow, discharged from his bow. These particulars are stated with some fulness.

2. Having settled the country, he called in *Brahmans* from the *Arya-vrata*, and located them in the country: according to this document, he advised the calling in of a king, from the *Chola* country. The document omits any mention of the fishermen made *Brahmans*, or of his displeasure against them. In other documents, the calling in the *Brahmans* from Hindustan is ascribed, not to *Parasu-Rama*, but to *Mayura-verma.*

Two Sanscrit *slocas* referred to, in the Telugu portion of this report, on examination, are found to be incomplete; and of no importance. There are imperfect lines, copied from different fanes, in the *Bhat-Malayalam* character, but the dates are only of the *Collam* era; and they offer no information of consequence.

Manuscript book, No. 12.—Countermark (torn of), *Viveca Sindhu*, intellectual wisdom.

A theological series of instructions, from a preceptor to pupils, written in the Balband character, and remaining in extremely good preservation.

Notandum.—The second part of my sixth report is thus concluded.

Madras, *November* 1838.

VII.—*Notes, principally Geological, on Southern India; from the banks of the Tumbuddra to those of the Cauvery.*—By Lieut. Newbold, 23*d L. I.*

A line drawn from the confluence of the Tumbuddra and Hogri rivers, passing southerly, and a little westerly, through Bellary, Raidroog, Chittledroog, Sera and Chinraipatam, to the fortress of Seringapatam, will give the reader a tolerably correct idea of the route, on which these notes were taken. On my return, a route a little to the east of this, by Bangalore, was pursued.

A wide expanse of sand, apparently more than a mile in diameter, marks the junction of the two rivers just alluded to. A few granitic blocks and bosses rise from the surface of this arenaceous waste, on which may be traced distinct furrows, with a direction parallel to that of the stream. They possess all the appearance of having been caused, like the furrows on the Scandinavian rocks, adduced by Sefström among his evidences of a vast ancient flood, by the abrasion of pebbles, swept over the surface by the force of water. But these furrows are still in process of formation, and undergoing alteration, under the continually renewed action of the periodical monsoon. They are generally from one to two inches broad, coinciding in dimensions with those of the rolled pebbles, found in the river bed in this vicinity, the small size of which indicates the transporting power of the water not to be very great. The depth of the furrows varies; and, in some places, has been influenced by the hardness or softness of the rock in which they occur. A few tough quartz veins have successfully resisted the abrading process, and are seen standing out, in high relief, from the surface of the worn rock; some indeed, have even formed barriers across the furrows.

From the Tumbuddra to Bellary, the face of the country presents an extensive plain, gradually rising as the traveller progresses southerly. A little to the east of Kurgode, it slopes off gently to the east and west, as evinced by the course the lesser streams take on their way to join the Tumbuddra and Hogri. The anticlinal line, if I may so term it, is marked near Beylour, by a low range of hills, having a smooth outline, and running from Dasapur nearly S. S. E., and thence pursuing a N. by W. direction, towards the Tumbuddra. The rocky swells, and granitic elevations, in the vicinity of Tekkulkota, are situated within the limits of this line. Many of the springs and rivulets, that water the plain, abound in calcareous matter, which is observed on their beds and banks, both as a nodular and travertine-like deposit. The soil covering the surface, is the *regur*, more or less mingled with the debris of the subjacent rocks, and the calcareous infiltrations of springs. The substratum is generally decayed granite or gneiss, but in many places a thick bed of the nodular calcareous deposit, or of a conglomerate of the granitic debris, cemented by it, intervenes, as may be observed at Tekkulkota, in the wells of the village. Around the bases of the granite hills, the regur is generally covered by their alluvium, which is reddish and gritty. Crossing the plain in a southerly direction towards Tekkulkota, the granite is seen rising into clustered hills, both at this place and Sirragorra, having a general direction to the S. S. E., though confused when taken in detail. Salbandes of gneiss are observed in the plain, between these two places, and also beds of a chloritic and hornblende schist, running S. S. E., which alternate with the gneiss.

Kurgode.—At this place the granite again rises into hills, not remarkable for their height—direction more easterly than those of Tekkulkota. A well, about 50 feet deep, at a little distance from the base of the hills, affords the following section:—3 feet regur; 45 feet calcareous nodular deposit, cementing angular fragments of granite, and boules of basaltic greenstone; 2 feet granite. The rivulets in this neighbourhood deposit a considerable quantity of carbonate of lime.

Bellary.—The fort of Bellary stands upon a convex mass of granite, the outline of which resembles the hull of a vessel reversed. Gneiss, imbedding garnets and iron pyrites, occurs in the plain: this rock, as well as the granite, between Bellary and the Tumbuddra, is cut by numerous basaltic dykes, the direction of whose main branches is generally easterly, inclining towards the south. From Bellary to Manchanhully, the route lies, as far as Halicundi, over the surface of a plain, intersected by date nullahs. A greenstone dyke is crossed to the N. E. of the latter place, and a little to the S. W. a range of hills, taking an east by southerly direction, composed of chloritic and hornblende schist.

Manchanhully.—Formation gneiss, and a fine grained granite, containing nests of black, brown, and silvery mica, in small scales.

Raidroog hills and Gorisamudrum.—The Raidroog hills are of gneiss and grey granite. Veins of iron ore (hæmatitic), and nests of mica, abound in the former. Direction of the hills N. by W.

Bomanhully.—The lowest rock here is of a reddish felspar, rapidly decomposing, traversed by beds of greenstone.

Chittledroog.—The hills on which the fort stands are a cluster of seven, terminating the northern extremity of a mountainous crescent. They are composed of a coarse-grained crystalline granite, containing a large proportion of quartz, black foliated hornblende, white and red felspar, and a little mica. The general outline of these fortified heights resembles that of the rocks near Bellary: vast blocks, both rounded and angular, resting on a large convex plateau, and near the base forming caverns. The height of the most elevated has been calculated at 800 feet above the plain. The general direction of the range is N. by E.

Herrioor.—The bed of the Hogri here is of clay slate, into the composition of which, chlorite and a little mica, in minute darkish scales, enters; giving the rock a speckled appearance. Some varieties are compact, hard, and of a fibrous structure; others sectile, earthy, and dull. Thin fragments of the latter, held in a platinum forceps before the blow-pipe, fuse partially, but with difficulty, on the edges into a greenish grey enamel. The surface of the plain is undulating, and covered with fragments of the subjacent schists.

Sera.—The country between Herrioor and Sera, is a succession of plains, the principal rock of which is gneiss, crossed to the E. by dykes of greenstone; beds of a hard mica slate occur, traversed by veins of ferruginous quartz, and quartzy iron ore.

Curbah.—From Sera, through Columbella and Chuloor, to the vicinity of Curbah, the surface of the country is an undulating table land, gradually rising towards Seringapatam—the formation much the same as between Herrioor and Sera.

Near Curbah, however, the principal rock appears to be of a white quartz, with talc disseminated. The whole has a schistose structure, common to many of the rocks in the vicinity of Seringapatam. A brown variety, with mica in spangles, resembles avanturine. Compact kanker and nodules of hæmatitic iron ore, are found here in beds, near the surface.

Belloor.—Approaching from Myasamudrum, the Mysore plain, or table land, is diversified by two low broken ranges of hills, of a fine grained grey granite, with small crystals of shining felspar. A coarse sort of gneiss is found in the beds of nullahs in the plain, with largish scales of silvery mica, and crossed by beds of talc slate with chlorite.

Near Belloor, these hills subside into a rocky swell, on which rests both masses of granite and gneiss. At Belloor, the lowest stratified rock I observed (18 feet below the surface), was gneiss abounding with small scales of glittering black mica. The strata were slightly inclined—dip west. Potstone, talc, and chlorite slate, associated with the gneiss, are found in the neighbourhood. Direction of the hills nearly due north.

Nagamungalum.—Plain – formation gneiss, with both white and pale red quartz. Dip of strata 41° to the westward. Direction north.

A little to the west of the fort runs a low ridge, with a smooth undulating outline—the formation of which is a variety of talc and mica slate with chlorite.

Sravan Belgola.—The road from Nagamungalum to Belgola, lies over a succession of low roundish hills of gneiss, abounding with large plates of silvery mica. The higher peaks and tors, as well as the rock on which stands the Jaina colossus of Gomutu Raya, are of granite. The latter rock is a steep convex boss, crowned by the usual detached, irregularly shaped masses of a fine grained granite, consisting of granules of cloudy quartz, and felspar of a pale rose colour, with small black scales of mica. The ascent to the temples and colossus, on the summit of the principal hill, lies over the steep convex rock, which is rendered slippery by the bare feet of the priests and pilgrims that frequent the place. I observed several inscriptions in Canarese on the surface. The temples and porticos are of simple, massive and elegant architecture, particularly the entrance to the quadrangular enclosure, in which stands the Jaina colossus. The effect produced by the first view of the statue on passing into the quadrangle, is singular and imposing; but a close inspection can hardly be gratifying to the eye accustomed to the exquisite proportions of the statues of Europe. It is about 70 feet high, entirely divest of drapery, in an erect position, facing the north, and has the curly hair, large pendulous ears and thick lips, so peculiar to Jaina images: the placid expression of the features reminds one of the head of Memnon: the legs are wreathed with the leaves of a parasitical plant (the ratimulla), sculptured in the granite, and together with the hands are clumsily executed. The opinion of the Duke of Wellington, that the rock had been cut down until nothing but the image remained, I found corroborated by the statements of the oldest priests, and a personal examination of the base. Two black slabs, bearing long inscriptions, copies of which are lodged in the library of the Literary Society of Madras, stand on each side the entrance into the quadrangle.

The village lies between the two hills; it contains, besides temples, a handsome Jain college, a large bouri, the white houses of the Shravaks, or Jain laity, and the dwellings of a few Hindus and Mussulmans.

Seringapatam.—The principal rock seen in the island of Seringapatam is gneiss, associated with mica and hornblende schist, and also with a schist which contains both these minerals combined with felspar and quartz. The best section of these rocks is seen in the fosse surrounding the fortress: as we proceed from the Wellesley bridge towards the Mysore gate, we observe dykes of a silicious rock*, penetrating the gneiss, and in some places overlapping it for a short distance on either side the dyke. This rock, like the trap rocks of Bijapore, has a tendency to the schistous structure, and splits like them, when struck by the hammer, into angular fragments, the superficies of which, exhibit similar dendritic appearances, but more perfect. The fissures by which the rock splits (the dry cracks of European miners), as may be discovered by a microscope, and often even by the naked eye, are pre-existent in its structure, and resemble those in basalt and other substances, which have cooled, after being greatly heated. The dendritic appearances in igneous rocks have been ascribed to the infiltration of metallic oxides, and with more show of reason to electric currents, circulating through the pores of the rock; but in some instances, particularly in rocks of acknowledged aqueous origin, they assume so much the character of mosses and ferns, that it would be matter of some interest, if botanists would institute a minute enquiry into the forms usually seen in each rock, with a view of ascertaining the question of their organic origin. In rocks of a decidedly igneous character, the arborescent appearances are generally far less perfect than those in limestones, and other rocks of deposition; and will be probably found, as just remarked, to be occasioned by the metamorphic powers of electric currents, acting upon metallic particles disseminated in the substance of the rock. The beautiful arborescent outlines in mocha stones are now supposed to arise from mineralized plants of the cryptogamous class, and Dr. Macculloch has detected both in them, and the moss agates, aquatic confervæ, unaltered both in colour and form, and coated with iron oxide. An onyx agate belonging to the Earl of Powis, contains the chrysalis of a moth; and the red colour, observable in this class of minerals, has been discovered by M. Turpin to be owing to an insect, the *Protococcus Kermesinus*, in form of seminules, or red globules. M. Gaulty de Chaubry found, that when powdered cornelians were mixed with black oxide of copper in a porcelain retort, and heated to redness, carbonic oxide and carbonic acid were disengaged; and some pyro-acetic acid, and pyrogenic oil formed: proving that the colouring matter of the mineral is of an organic nature. Apologising for this digression, I shall rest content for the present, by calling attention to this curious subject, expressing at the same time, my strong belief, that many appearances in transition and secondary rocks, hitherto considered as inorganic, are, in truth, lapidifications of animal or vegetable matter.

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* This rock is probably identical with that described as a hornstone by Buchanan, and a silicious slate by Dr. Benza; the fissures imparting a schistous character to the rock, do not resemble the laminæ, of deposition.

The formation of the silicious rock is evidently posterior to the gneiss, as we see it, as before mentioned, not only slightly overlapping and penetrating it, but also penetrating the associated brilliant hornblende schist. It appears to be however, anterior to the intrusion of the greenstone dykes, in the *immediate* vicinity, one of which is seen in the fort ditch, slightly overlying it. It is generally of a greenish grey colour, tough, compact, translucent at edges, fracture semiconchoidal, sometimes containing minute shining felspathic crystals. Before the blow-pipe per se it whitens, and melts slightly, and with difficulty at the edges: fuses with carbonate of soda, with effervescence, into a greyish white enamel. An opaque variety, which appears to consist entirely of compact felspar, melts without much difficulty per se into a light grey enamel.

A dyke of red porphyry (noticed by Dr. Benza), is seen crossing diagonally the bed of the Cauvery, opposite the sally port, where Tippoo fell covered by the wounded and slain. The direction of the dyke is N. 40 E. It consists of flesh-coloured felspar crystals, imbedded in a paste of the same mineral, but of a deeper red, having a number of dark green acicular and prismatic crystals, resembling tourmaline, disseminated. The gneiss at the junction, presents few indications of alteration, beyond being rendered more compact and indurated. Large deposits of tufaceous kanker take place on the banks of the river, consisting generally of a whitish grey carbonate of lime, with a sponge-like structure, imbedding nodules of a more ancient formation, and a more compact variety ; also bits of felspar, quartz, &c., debris of the subjacent rock, and roots of grasses. The gneiss is traversed by pegmatitic veins of red felspar, and a light grey translucent quartz, which are themselves penetrated by thin veins of compact felspar, tinged of a faint pistachio green, probably by actynolite, a mineral generally found associated with the pegmatitic veins. The rock composing the green veins, before the blow-pipe, first reddens; secondly becomes black, and finally melts into a dark emerald.

Island of Seringapatam.—The island of Seringapatam is formed by the bifurcation of the Cauvery into two streams, which again unite a little to the eastward of their separation. It is about four miles in length, and about one and a half in breadth in the middle. Its surface is convex, sloping to the streams on either side. The fortress is situated on the western extremity, and the suburb of Shahr Ganjam, about the centre of the island. Near this, in a cypress garden, stands the handsome mausoleum of Hyder and

Tippoo. This mausoleum is supported by finely polished pillars of a dark rock, containing black crystals, in a dark paste, rendered still darker by the oil, with which the pillars appear to be constantly rubbed. Buchanan thought these spots were dark crystals of basaltine, or augite, imbedded in the hornblende; and Dr. Benza, who subsequently visited the locality, is also of this opinion, adding moreover, that the hornblende rock of the dykes, in the fosse of the fort just described, is identical with that of the pillars. We are, however, informed by Buchanan, that the rock, from which the pillars are cut, was brought from Cudhully, near Turivicary, about fifty-two miles N. E. from Seringapatam.

After a careful examination of the pillars in the mausoleum, and a fragment of them given to my friend Captain Allardyce, by the mullah of the mosque, and of the rock in sitû at the quarry of Cudhully, near Turivicary, from which it was cut, during a subsequent visit to this part of Mysore, I feel assured that the hornblende rock of the dykes at Seringapatam, and that composing these beautiful columns, are by no means identical. Had they been so, the natives would not have gone fifty-two miles to quarry stone, which might have been procured on the spot. The Cudhully rock, and that of the pillars, is composed of a dark talcose paste, imbedding black crystals of a mineral, strongly attracted by the magnet. This paste is sectile, and infusible per se before the blow-pipe. The hornblende rock of the dyke on the contrary is hard, and fuses into a greenish black glass: the imbedded crystals of this mineral, decomposing, often fall out, imparting a variolated appearance to the surface. The geological situs of the talcose rock will be described in a future paper; suffice it to observe that it is associated with the talc slate.*

The Cauvery river.—The Cauvery at Seringapatam, during the rains, is a deep and rapid river; but easily fordable during the dry season: the bed is rocky and encumbered by large fragments of granite and gneiss. Its bed cannot vie with those of the Kistnah and Godavery, in precious stones, corne-lians, agates, &c. Granite, greenstone, and gneiss, imbedding corundum, and, though rare, the ruby, with its associated schists, are the rocks generally passed over by its waters. Garnets and iron ore are, however, frequently found in the bed; corundum seldom. This beautiful and sacred stream takes its rise among the Coorg mountains, and traverses the peninsula in an easterly by southerly direction. After watering a large part of Mysore, it descends into Coimbatore at the falls of Sivasamudrum, and, passing Trichinopoly, disembogues its waters through various channels into the Bay of Bengal, between Porto Novo and Adrianpatan. It contributes immensely to the fertility of the countries through which it passes; its waters are conveyed into the fields principally by means of water-courses, and anicuts, constructed at a vast expence by the Hindu princes of Southern India. Two crops of rice are, in general, annually produced on its banks, besides large quantities of most excellent tobacco, sugar-cane, &c. The soil brought down by it is a fine rich clay, produce of the disintegration of the rocks over which it passes, and often mingled with a considerable portion of carbonate of lime, deposited by its waters, and decayed vegetable matter. It is navigated principally by basket-boats, and conveys the produce of Salem, Coimbatoor, and Trichinopoly to the sea.

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* See note on this subject at the end of this Journal.—*Editor.*

Having reached our southern limit, we will now return northerly towards the Tumbuddra, by a different, though almost parallel, route, lying to the east of that just described.

From Seringapatam to Bangalore the formation is principally gneiss and hornblende schist, penetrated by veins of actynolitic and chloritic felspar. The rocks in the vicinity of Bangalore are granite, gneiss, and greenstone, in dykes, penetrating them generally in a west to an easterly direction. Tabular masses of a lateritic rock overlie the gneiss, a little to the N. W. of the cantonment. Passing from Bangalore, the geology of which I shall have occasion to notice in a subsequent paper, the road lies in a northerly direction, towards the celebrated stronghold of Nundidroog.

Nundidroog.—Gneiss, with a few clusters and detached hills of granite rising above the undulating level of the table land, are met with. The soil is generally a bluish red, loamy clay, and a quartzy detritus, abounding in ferruginous nodules—debris of the lateritic rock, which is seen on the surface in scattered patches. Near Yellavunkah I observed a mass of it covering the surface of the road, and again noticed it near Nundidroog, where it was partially employed, with other stones, in the construction of a bund of a tank. This contained much less quartz than the former, nor was it so porous. A little north from Deonhully, a hill, principally of gneiss in contorted strata, is seen, with a nearly north and south direction. Its southern extremity is crossed, from west to east, by two basaltic greenstone dykes; the first of which bifurcates on entering the hill from the west: the larger branch pursues its course through the hill without much interruption, and sinks beneath the surface of the soil on the opposite or eastern side. Its breadth is from 15 to 20 yards. The rock through which it passes, particularly on the left side of the dyke, where it has a scarp of above eight feet high, has the appearance of a channel cut in the rock. The left branch of the bifurcation gradually diminishes in width, till it finally disappears in the substance of the rock, after performing an easterly course of more than 200 paces. The second stream is not so wide as the first, and passes through a higher part of the hill. After cutting the summit and giving off one or two minor branches, it separates into a number of ramifications, which spread out, become thinner and shortly disappear. They sometimes cease abruptly, and re-appear at short intervals. Short parallel veins are observed at a little distance from, but having no connexion with, the main stream. These facts, which I have observed in other parts of India, and the disturbance observable in the rocks in which these dykes intrude, incline me to the belief, that the primitive rocks, in which they are found, must have been in many cases, riven in a nearly solid state by a force from below, the vibrations of which proceeded nearly at right angles with the poles of the earth, and thus formed vents for the liquid basalt, struggling up from beneath. That the imbedding rock is not contemporary, and did not exist in a state of fusion with the basalt, is indicated by the wall-like escarpments, cut shear, as if by the chisel, through the former, into conduits for the escape of the latter. There is here no passage of the one into the other; a decided line of demarcation exists throughout. Veins of quartz and felspar existing in, and apparently coeval with, the granite itself, are seen divided by the basaltic stream, and solid fragments of the former imbedded in its course. Others, still larger, are frequently entangled between the ramifications of the basalt; and, in detached blocks, occasionally resemble a vein of granite in the basalt.

In conclusion of these remarks, I may add that, in dykes of considerable width, both sides of which are bounded by walls of granite, the latter rock becomes altered, as though by igneous agency, whilst the former, on its approximation, becomes compact and comparatively dull, the consequence of sudden refrigeration from coming into contact with the granite. Towards the centre of the dyke the basalt becomes more granular and crystalline, and sometimes porphyritic, imbedding crystals of a greenish felspar: acicular crystals of augite occur in both. The surface has a slightly blistered appearance. Where basalt is found encrusting gneiss, its edges are found graduating into a thin coat of greenish eurite, the surface of which is frequently vesicular, the cavities containing a yellowish brown powder. This euritic basalt acquires a greyish green hue, imbedding small crystals of epidote and frequently yellow iron pyrites. It also retains a portion of the augite; exchanging the dark crystals of hornblende for the light green epidote. Angular masses of dislocated granite, with fragments of the basalt adhering to them, are frequently found in the vicinity of these dykes. The deep vertical fissures, we often see cleaving from summit to base whole hills of granite, divide also the basaltic veins. At what period these fissures and dislocations have occurred—whether from foreign disruptive causes, or from that spontaneous separation, to which it is well known granite is subject, is difficult to determine. It seems certain that they are posterior to the irruption of the basalt.

The rock of Nundidroog rises to the alleged height of 1,700 feet above the surface of the plain, at the southern termination of two ranges of hills. The western range has a N. W. direction, the eastern proceeds nearly due north, until it approaches Purniah Chatram, whence it bends its course to the N. N. E. to Worralconda. From Worralconda it extends northerly to Sondoo; thence sweeping to the N. W. it enters the Ceded Districts. A range is observed some miles to the east of Purniah Chatram, which has hitherto a N. E. direction, but here bends towards the west. The valleys, as in the Nundidroog range, appear to cross the line of direction, their course being nearly east and west. A hill called Chinna-raya-conda, a little north of Nundidroog, and the next in the range, was pointed out to me as the site of the sources of the rivers Pennaur and Palaur. The former takes hence a northerly course, and falls into the Bay of Bengal, near Nellore. The latter pursuing a southerly course to the east of Bangalore, adds its waters to the ocean near Sadras. This fact, if it does not prove this to be the highest part of the table land of Mysore, demonstrates the descent of the land hence to the north and south.

The hill of Nundidroog is a mass of granite, on the sides of which rest blocks of the same rock, and dislocated masses precipitated from the summit. Among them are occasionally seen globular and angular blocks of trap, indicating the vicinity of a dyke. At the base granitoidal gneiss is seen near the summit, impending cliffs of granite and sienitic granite rise to the apparent perpendicular height of 60 or 70 feet above the rest of the rocks, cleft by vertical fissures, and without the slightest appearance of stratification: this rock contains both a brownish and white felspar: a small grained sienitic variety with a light green chloritic hornblende also occurs. But the variety which predominates has crystals both of a translucent (albite) and opaque whitish felspar; the latter projecting on the surface give the rock a peculiar white mottled appearance. Porphyritic veins imbedding large crystals of foliated felspar, with plates of a dark green mica, intersect this last rock.

Worralconda.—From Nundidroog the road passes through Purniah Chatram and Worralconda, along the eastern flank of the Nundidroog chain, some spurs from which are crossed *en route*. The Meta-Meyrecotta ranges lie some miles to the right. The formation, as far as I was enabled to judge from the examination of the spurs just alluded to, and of some detached masses, and the appearance of the peaks of the highest hills, is similar to that of the hill of Nundidroog. Several greenstone dykes cross the plain, from west to east, between the two ranges. One, close to Worralconda, has a northerly direction. I followed its course some distance beyond the village, in the expectation of seeing it unite with a large westerly dyke, of which I supposed it to be a branch, but was disappointed by its dipping beneath the soil, and thus eluding my search. Retracing my steps south of the village, I had the satisfaction to see this surmise verified by its joining the main westerly dyke. Ascending a large mass of granitoidal gneiss composing the Worralconda hill, I observed another, but smaller dyke traversing the rock in the same direction. This also joins the main dyke a little south of the hill —it exhibits brass-coloured pyrites, and needle-shaped augite crystals. Flanking the larger dyke, beds of both a red crystalline and compact felspar occur, with quartz and thin veins of chlorite, as well as a greenish eurite which appears to owe its colour to epidote. This eurite graduates into basaltic greenstone, like that of Deonhully. Magnetic iron sand is obtained from the beds of the nullahs in this vicinity, and indeed, throughout the taluk, and smelted.

Baugoopully.—The Nundidroog range appears to terminate a few miles N. of this place, as the Polla range on the right is approached. Several trap dykes stretch across the plain, between the two ranges, with an easterly direction. One of them a little to the west of the deserted village of Mangsundrum, gives off branches to the north and south. The latter throws off a vein, which, entering into a convex mass of gneiss, spreads out into numerous, and occasionally intersecting, ramifications. About a mile south of Baugoopully the plain is strewed with bits of ferruginous quartz, reddish felspar, with fragments of a compact actynolitic vein: a little farther on, the latter is seen in the bed of a nullah, partly lying in lamellar masses on the top of weathered gneiss, and partly in thick veins, running a W. N. W. direction, and having a dip of about 40° to the south. Between it and the gneiss, I observed a layer of a reddish felspar and quartz, varying from half an inch, to several feet in thickness. This frequently becomes veined with the lively green of the actynolite, and acquires a schistose character. The actynolite rock, *vice versâ*, imbeds crystal of a flesh-coloured felspar, forming an elegant porphyry. Green mossy looking crystals of actynolite may be seen between the porphyry and the embedding felspar rock. Veins of a transparent quartz intersect it, and near them occur imbedded cubic iron pyrites; iron ore in reddish octahedral crystals also occurs. The rock imbeds pure actynolite, in long striated diverging crystals, filling up small cavities, and shooting out on the surface. The rock is remarkably tough, heavy, generally crystalline, but sometimes compact as eurite; translucent slightly at the edges, fracture uneven. The superincumbent soil is red; beneath it is a detritus of ferruginous quartz pebbles, pieces of actynolite slate, felspar, pisiform iron ore, and a few rounded fragments of basaltic greenstone, which exfoliate in concentric layers. In most of the fragments, even in the gneiss itself, I observed a tendency to assume a pentagonal and hexagonal form. I also picked up a crystal of corundum imbedded in a brownish talc. A greyish brown kanker is found on the banks of the nullahs.

Close to this place, crossing the rocky hills from east to west, I observed a broad dark band descending the hill side, which I took to be a basaltic dyke, since directly west of it we crossed one in the plain, exactly in the line of its direction. This I found to be the case on ascending the hill, which was composed of porphyritic granite, in large unstratified masses, with crystals of a magnetic iron ore disseminated, generally grey, but sometimes imbedding shining crystals of red felspar. The summit is crowned by vertical masses of this rock, having a tendency to exfoliate in thick layers. Near the base is a convex mammillary mass of the same rock, in which the crystals of felspar and nests of mica had a nearly common direction viz., north and south, following the line of elevation of the hill itself. The dyke of basalt passes completely over it, at right angles with its direction, and is seen crossing the plain on the other side to the eastward. Its breadth at the base of the hill is about ninety paces, and at the anticlinal line of the ridge about seventy. Over the southern extremity runs another dyke, or a branch of the one just described, of much less width. Both are distinctly visible at a considerable distance passing through the grey cliffs like the dark stream of a muddy cascade.

From Baugoopilly to the frontier of the Ceded Districts, the formation is gneiss, crossed by numerous basaltic dykes, throwing off ramifications to the north and south. Flanking the dykes are seen veins of the red felspar and quartz rock, imbedding actynolite slate, and the porphyritic actynolite. The gneiss strata are nearly vertical; general direction north and south. It is interstratified with the micaceous hornblende schist, and intersected by pegmatitic veins of red felspar and quartz. A magnetic iron sand is found in some spots on the road the vicinity of the trap dykes, which has probably resulted from th decomposition. Most of the basaltic greenstone found here sligh affects the magnet.

Palsamudrum.—From the Mysore frontier to Palsamudrum, the f mation is thick bedded, or granitoidal gneiss, in highly inclined stra Masses of granite occur detached, precipitated apparently from t peaks in the vicinity. The gneiss is intersected by basaltic greenst dykes, running generally in an easterly direction, from the Polla ran on the right, across the plain, towards some outliers of the Nundidro chain on the left or west. A few of these dykes take a north a south direction, but appear to be ramifications of the former. Vei of actynolite slate, generally flanked by pegmatitic beds of a red fe spar, with a transparent quartz, traverse the gneiss in the neighbou hood of the greenstone dykes, with whose direction they in a gre measure conform. Kanker is seen in compact nodules, both of a gr and reddish colour, on the banks of the nullah; and, though rarel forming small mammillary mounds, apparently around the mouths the extinct or dried up springs by which they probably have been d posited. A few miles south of Palsamudrum, flanking the greenston I observed some angular blocks of sienitic granite, consisting of opaque felspar imbedding crystals of schorl, with a little grey quar

The basaltic greenstone in every way resembles that of Baugoopill The augite crystals on the surface decay into a reddish white eart which, falling out, leaves the cavities observable on the surface. Cry tals of felspar imbedded in it are subject to similar decay, leaving larg cavities. Magnetic iron ore, in crystals, is found in most of the roc of this place.

Terimany.—From Palsamudrum towards Jaulipett, the road lies pri cipally through a valley between two short ranges, apparently of gnei and granite, which run in a north and south direction. The valleys breaks form acute angles with the line of direction. The hills are rock masses, covered with their own exfoliated fragments, and destitute vegetation, save a few bushes principally of cacti, euphorbia, and m mosa. Emerging from the valley a little south of Jaulipett, the indent outline of a long range to the west, pursuing a parallel course to tho on the east, appears on our left, at a considerable distance. Spurs fro both ranges are thrown across the plain, and form partial barrier North of Jaulipett, the eastern range terminates in the rock of Pe naconda, about a koss and a half from Goghirry. A few detached ou liers continue nearly to Terimany. The western range still boun the horizon to the left, preserving a deeply indented outline. The ga in both the ranges seem to have a parallel direction. Indications the regur appear in this vicinity, and abundance of a whitish grey kanker. Gneiss, interstratified with micaceous hornblende slate, is the principal rock found in the valley, and on the plain. Strata nearly vertical —direction northerly—dip to the east. In a nullah near Somundapilly, is a bed of gneiss, with actynolite in tabular friable crystals, with the usual band of felspar and quartz intervening between it and the gneiss; the latter rock in the vicinity of the bed is contorted. A dyke of basaltic greenstone running east and west was not many paces distant. Both this rock and the actynolite are not so often seen.

Magnetic iron sand, is procured in the neighbourhood of Paupreddy, a village about five miles from Palsamudrum, and there smelted. I saw only one furnace, which is of much smaller dimensions than those at Kootul in Mysore. There are furnaces, I am told, at Niddamaumri, in the adjoining taluk of Pennaconda. I observed a few patches of regur in the low grounds about Jaulipett. The gneiss, about this place, where it has been penetrated by the basaltic dyke, is solid and compact, resembling close grained granite. A greenish eurite in thin veins traverses many of the blocks, giving them a schistose structure.

The gneiss frequently imbeds large crystals of a white felspar, which impart to the rock a porphyritic appearance, singularly contrasted with its own lamellar form, and can scarcely be judged of in a hand-specimen. A greyish white, and rather friable kanker, is found at a little distance beneath the surface, in beds about a foot deep, and penetrating the subjacent gneiss. Near Raichoor I saw a rude stone and clay furnace for burning it into chunam, about four feet high and 20 inches in diameter. Salt-pits are excavated on the banks of the nullahs. N. E. of Goghirry at the foot of the hill of *Shah-du'rgum*, lies a low hill, crested with dark looking rocks, visible at a great distance, which are easily recognized to be part of a basaltic dyke. It is shortly afterwards crossed about half a mile to the east of the hill, and is about 30 paces broad—direction, east. Two others of less dimensions are crossed shortly afterwards: they have a similar direction. Fragments of actynolite slate are frequently picked up, and it may be seen in thin veins traversing the red pegmatite. A section of a well at Terimany, about 25 feet deep, presents the following strata: 3 feet gravel; 4 feet grey earth; 18 feet beds of red felspar and quartz, with decaying greenish earth, and friable kanker in veins and fissures.

Gneiss is, as before remarked, the prevalent rock: at the same time it must be observed, that blocks of granite, and a red quartz rock, resembling that cresting the sandstone and clay slate formation of Cuddapah, are seen in the walls of the fort and choultry, probably brought from the range north of Anantipur, which appears to be a continuation of the sandstone ranges of Gooty.

Peroor.—At Peroor, a village situated upon the eastern bank of the Pennaur, the range on the right ceases altogether, while that on the left or west (the Condaganpilly range), wears a smoother aspect, and turns off to the west. The quartz rock mentioned at Terimany, here occurs in sitû, in a bed of a nullah, a little to the east of the fort: it rests uncomformably in almost tabular masses on the surface of the gneiss. It is both massive and schistose, according to position; massive when seen in blocks protruding from the surface of the soil, and schistose, generally, when found in contact with the gneiss. A thick bed lies at the bottom of the nullah. In structure it varies from that of gneiss, to that of the red granular quartz rock of Cuddapah, and contains but a minute portion of mica. The gneiss is generally much weathered, and abundantly seamed by incrustations of kanker. Its strata are not so much inclined as hitherto, having a dip of about 25° to the E. S. E.—direction as before. Beds of the micaceous hornblende schist are seen, commonly with the same dip and direction as the gneiss. The greenish eurite and accompanying pegmatitic veins, like the basalt, frequently intersect the line of direction at considerable angles. They are of more recent date than the quartz veins, as is shown by their passing through them. At the points of contact, faults or dislocations are sometimes seen in the latter; an instance occurs in the gneiss of this nullah. The dislocation is of a few inches, in a W. N. W. direction. Granite is still seen in detached masses. Beds of the micaceous hornblende rock are observed in the wells, disintegrating into a greenish friable substance, and exhibit various stages of decomposition in the same mass. The mica is seen more distinctly in the decayed portion; it changes to a silvery brown which gradually loses its brilliancy. The hornblende decomposes with the felspar, into a light dirty green friable rock, mottled with ferruginous spots. Probably the hornblende is combined with actynolite, which not only gives the rock a schistose character, but imparts much of the green in decomposition. The eurite near this mass does not appear to be in the slightest degree altered. This rock, like basalt, is more crystalline in the middle of large veins. In small veins it becomes compact, heavy, extremely tough, and shows a disposition to split into rhomboids. Crystals of epidote occur in the gneiss near the greenstone dykes.

Rampur.—This place is situated on the right, or western bank of the Pennaur, which is here upwards of 200 paces broad, taking a bend to the east. Its bed is of sand, from which the subjacent gneiss and micaceous hornblende slate occasionally protrude. The surrounding country consists of undulating plains, interspersed with a few scattered hills. The ranges running to the north are no longer visible, except a few peaks above the western horizon. The formation is much the same as at Peroor, but the micaceous hornblende schist is more abundant. Fragments of schist, felspar, and ferruginous quartz cover the surface. Among the debris I picked up several bits of a ferruginous jasper, and potstone, translucent, of a faint green, and imbedding plates of mica. Potstone is said to be dug, not very far off, at a place called Reddorpilly, in the Durmaveram taluk. A hill of gneiss, about one and a half mile in a north west direction from the village, is intersected and entangled in a singular manner, by two basaltic greenstone dykes, or the branches of a very large one having severally an east and an E. N. E. direction. I observed two of the ramifications cutting through beds of the micaceous hornblende schist. The mica and felspar of this rock are altered by contact, much in the same manner as granite and gneiss. The gneiss of this hill contains both red and white felspar, and large nests of glittering micaceous hornblende, veined by the red felspar. Porphyritic veins of this mineral with translucent quartz occur, having crystals of a highly magnetic iron ore disseminated. Some fragments of gneiss have a schistose appearance, from the presence of actynolite or crystallized talc, or both. Talc in its crystallized form imparts a schistose structure, as before observed: and in its earthy form, it softens the gneiss, gives it a green tint, and a slightly greasy feel. This may be observed in the fragments in the walls of the fort.

Gollah.—Formation same as at Rampur; between it and Gollah one or two basaltic dykes are crossed, which, with a single exception, had an easterly course. Natron occurs in the beds of the rivulets, and a quartzy magnetic iron ore is found imbedded in the micaceous hornblende schist: the latter is smelted at Almireddypilly, and at four or five other places in this taluk (Durmaveram). The wrought iron sells at about 2 rupees 6 annas the maund of 48 seers, each seer weighing 24 rupees.

Bellagoopah.—This place is interesting on account of the great regur plain of Bellary having its commencement some distance to the S. E. of the village. Hitherto it has been seen only in detached patches, generally occupying banks of rivulets, and other low grounds: now it occurs spread out in one vast and almost uninterrupted level sheet, extending in all directions from the edges of the detrital soil, that forms a broad belt at the base of the hills to the westward.* The interruptions of the regur, when they do occur, will be found generally on the summits of the rocky swells, which are covered with a red soil arising from the detritus of the subjacent or protruding rocks. About 2 miles west of Bellagoopah, are two long hills, running nearly parallel to a broken range at a considerable distance to the west, with a W. N. W. direction. These hills are the last that appear in view; beyond them extends one broad expanse of plain. They are of gneiss with red felspar, and a hard dull mica: both white quartz and felspar occur: the red however, gives the general colour to the rock. Thin actynolitic veins are seen traversing it, though rarely. A basaltic dyke passes through the northernmost of the hills in an easterly direction. It has a dull green tint and imbeds iron pyrites. The hematitic and granular iron ore are scarcely seen, and the natron deposit becomes rarer. Common salt is got in abundance; both this, chunam, and saltpetre are manufactured at a village at a short distance hence. A loose block of a dark dull siliceous green rock, with waving lines of a light colour through its structure, occurs in the plain.

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* The *jatropha glandulifera*, a low shrub, almost peculiar to the regur, is now more frequently observed.

Regarding the manufacture of saltpetre, the natives of the locality were a little delicate in furnishing me with information. At first they said it was brought from the jungle, together with the earth from which common salt is washed. Next, that it was not procured from the jungle at all, but on the spot: and then that it was never to be found but in and about villages. On enquiring the reason for this, they gave evasive answers, but at last reluctantly confessed that it was got from earth saturated with urine, and other animal matter; which, with ashes and other refuse, are thrown together and allowed to remain till, I presume, the nitric acid produced by the decomposition of the animal matter combines with the alkali of the wood-ashes, and produces an impure nitrate of potash—the saltpetre of India. The process is something different to that for obtaining muriate of soda. The mass of earth is washed with water; which, after dissolving its saline contents, is evaporated to a certain extent by boiling. The solution of a dirty brown colour, is then poured into a cistern lined with chunam. Small branches and bushes are put in, on which the salt crystallizes. They are then taken out: the salt separated, either washed and re-crystallized, or dried for packing. It is sent to the Bellary and Madras bazars.

The direction of the strata at Bellagoopah is N. N. W—dip of 25° to the N. E.

Honoor.—The sections of the soil in the rivulets near this show a stratum of regur from 2 to 5 feet in thickness, lying on gneiss, micaceous hornblende slate, or the pegmatitic beds enclosing veins of a greenish eurite. In a bed of a rivulet I observed a basaltic greenstone dyke cutting through the gneiss, and the micaceous hornblende slate in an easterly direction. That of the gneiss and schist was here nearly N. W. The basaltic greenstone divides into its usual rhomboids, which again separate on percussion, exhibiting a hard globular nucleus. Furnaces for expelling the carbonic acid of the kanker, and reducing it to lime, are seen on the beds of the rivulets.

A little south of Honoor are the dunes described in the 23d No. of this Journal.

VIII.—*Essay on the Creed, Customs and Literature of the Jangams.*—*By* C. P. Brown, *Esq.*

The various Braminical creeds prevailing among the Hindus, as well as those of the Jainas and Buddhists, have been amply illustrated by COLEBROOKE, WILSON and other learned writers. It remains to enquire regarding the anti-braminical worshippers of Siva, who are called *Jangams*, Vīra-saivas, or Lingadharis, who are easily recognized by their wearing a small idol, either hung on the breast or bound on the arm. These are the disciples of Basava whom they regard as a form of the god Siva. They are widely spread throughout the South of India, among the Canarese, the Telugus and the Tamils.

Dr. Francis Buchanan, the Abbe Dubois, and Colonel Wilks have given short notices regarding the Jangams, which are summed up in Professor Wilson's Essay on Sects, in the seventeenth volume of the Asiatic Researches. But the information collected regarding the Saivites being far from sufficient, the learned professor did me the honour (when I was his guest at Oxford, in 1836) to desire me to obtain further information on points which remained very uncertain for want of sufficient enquiries made in the peninsula of India. On returning to Madras, I accordingly resumed an enquiry regarding the Jangams, the only saivite sect who deviate from braminical usages.

Among Bramins the Smartas (followers of SANCAR ACHARI) are generally called saivites, but are in fact free-thinkers, equally willing to adore Siva and Vishnu. Their creed may be found in the Mahabharat, the Bhagavat and the Rāmāyan, all of which are entirely rejected by the disciples of Basava. There are indeed, some few Siva Bramins who officiate as priests in the Siva temples, but I have not heard of any peculiarities prevalent among them. They certainly are different from the Smartas, who refuse to receive the holy water and rice (tirtha pras from their hands.

The Vīra-Saivas are divided into two sects: one is semi-braminical high-church, called A'ra'dhyas. The other is anti-braminical, and called Jangam. The Aradhyas claim to be descendants of saivi bramins, and between them and the Smartas there is a certain degree reluctant intercourse: founded upon the rites of initiation (upanay nam) which both parties use.

A brief outline of its history will enable us to understand the prese state of the Vīra Saiva sect: this is amply narrated in their poetic chronicles, written in Canarese and Telugu. When divested of fal lous decoration it seems that their creed was found by **Basava**, wh they adore as their one deity: looking upon him as an *avatar* or inc nation of Siva, the god of this creed.

Basava was the son of a Saivite[*] bramin, named Mandenga Ma mantri, at Hinguleswaram, a village near Bagwari in Belgaum, in Southern Mahratta Country. When he was a boy he refused (tl allege) to wear the braminical thread, because the rites that confer t mark of *initiation* require the adoration of the sun in the manner p cribed by the Vedas. Perhaps in truth he did assume it, but if so, subsequently renounced it. Shortly after this time he escaped fr his parents, and accompanied by his sister Acca Nagamma, he fle *Calianam* or Kulyan,[†] the capital of the Carnataca country, where reigning prince (A. D. 1155 circ.) was Bizzala or Vijjala, a Jaina religion whose minister a bramin, was Basava's maternal uncle: bestowed employment on Basava, and ultimately gave him his daughte marriage.[‡] At his death Basava succeeded to his office, and gradu usurped great power.

It would seem that at this time he began to compare the oppo statements of Jainas and Bramins: and perceived that both creeds w idolatrous. It is also possible that an observation of the Christian faith in the neighbouring country of Malayala may have led to his seeking a better creed. At all events he determined on getting rid of the braminical priest-craft, and accordingly refused to worship any deity but Siva, whose image, the lingam, is the most ancient idol known among the Hindus.

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[*] The Aradhya bramins pretend that his father was an Aradhya. This the Jang deny, asserting that the title Aradhya was assumed only when the bramin rites were nounced, and we no where find Basava denominated as an Aradhya.

[†] See Mr. Walter Elliot's Essay in the Madras Journal for 1838, page 212, or in Journal of the Royal Asiatic Society 1837 No. VII. p. 22, wherein it appears that s of the names herein mentioned are differently written in different Telugu and Cana authors. Compare also the statements made by that zealous and intelligent antiqua Lieut. Newbold, in his report upon the Southern Mahratta Country, printed in Pharo Madras Almanac for 1840, page 352. Calyanam is in the Nizam's country, 35 miles W S. from Beder. For this and a few other notes, I am indebted to Lieut. Newbold, wh me the favour to peruse these pages.

[‡] This proves, in my opinion, though opposed to that of his followers that he did lay aside the braminical thread in childhood. For had he done so no bramin could given him his daughter in marriage.

This symbol is as separate from indecency in the Hindu mind as circumcision is in the Mahomedan mind. The Bramins with their usual love of filth have connected a variety of obscenities with the linga worship, but these are wholly unknown to the Jangams who look upon this idol just as the catholics do upon a reliquary, with deep veneration

Hanging a golden stamp about their necks
Put on with holy prayers.

Macbeth, iv. 3.

The image erected in the Saiva temples being denominated Sthavara Lingam, or the stable image, he denominated this reliquary the Jangama Lingam or Locomotive image: a phrase borrowed from the Vedas, where it is used for living being. Hence he and his followers are denominated Jangams, or living images of the deity.

Before we proceed to describe his doctrines, we will give in a few words, the rest of the history of Basava, still referring our readers to Mr. Elliot's Essay (which gives the Jaina account), and to the Basava Puran which relates the story as told by the Jangams.

Basava's determined opposition to the Saivite Bramins and to the Jainas raised him many enemies: while his bounty to the poor gained him friends equally numerous. At last the prince's jealousy was roused, and a civil war ensued wherein Bizzala was slain A. D. 1168*, and this event was soon succeeded by the death of Basava who, according to his followers was "absorbed into the image" or vanished: while the Jaina account declares that he fled to Capila Sangam where the Malparba and Krishna rivers meet, about 104 miles west of Bellary.† This event was coeval with the murder of St. Thomas a Becket.

The name Basava is a very common one among Hindus: the Jangams have taken occasion from their teacher having borne it to feign that he was an incarnation of Nandi or Basava (the Apis or bull appertaining to Siva or Osiris), and this has been the source of numerous idle legends on the subject.

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* For this date I am indebted to Mr. Elliot who ascertained it since the publication of his Essay. It corresponds with the Saca year 1090.

† See Almanac as above, page 354.

At his death his nephew Chenna Basava became the principal teacher of this sect, which has in the following six centuries spread ver widely among the Canarese, Telugus, Tamils and Mahrattas. Th books concerning this sect were originally written in Canarese, but hav been translated into the languages now named. Those which I consulted are written in very elegant Telugu verse.

By perusing their books and observing their customs, we may plainly see the grounds of that hatred in which Bramins hold the Jangams.— Their leader Basava was the resolute opponent of every braminica principle. The Bramins inculcate the adoration of many gods. H declared that there is one sole deity. They venerate goddesses an subordinate beings. They reverence cows, hawks, monkeys, rats an snakes. They use fasts and feasts, penance and pilgrimage, rosarie and holy water. All these he renounced. He set aside the Veda which they venerate. They declare Bramins to be literally gods upo earth, women to be vastly inferior to men in all things, and parias t be utterly abominable. Basava abolished these distinctions. He taugh that all men are holy in proportion as they are temples of the gre spirit; that by birth all are equal; and among those whom the Janga books describe as saints, we find not a single Bramin but many parias and many women. In the braminical writings, the gentle sex ar usually treated in a manner abhorrent to European feelings. But i the Jangama books we find a very different temper. Here we fin woman raised to her proper station in society, such as she holds amon Christians, being treated honourably with a respect and delicacy whic form a strong contrast to the modes of expression we find in the braminical volumes.

Indeed the considerate and decent behaviour of the Jangam toward the female sex, is a very pleasing peculiarity which entirely divides them from other classes of Hindus. A Jangam once pointed ou to me that the manners of the native Christians towards women exactl resemble those of the Jangams. In the eighth chapter of his wor the Abbé Dubois has spoken with indignation of the impure customs, a he calls them, of this sect; but strongly as he speaks against Bramin he evidently wrote under their influence; and in thus condemning th Jangam customs regarding women, he omits to observe that in thes very respects Christians are equally reviled by Bramins: who certainly are much more scrupulous in their pharisaical precision regarding the outside of the cup and the platter than are either Christian or Jangams.

The following particulars regarding marriage, may give some insigh into the social state of the Jangams.

The forms of contracting marriage are the same as those which are used among other Hindus. Certain prayers *(mantram)* are read, and the *tali*, or bit of gold, is attached to the bride's neck as usual.

But it is not imperative to betroth the parties in childhood, as is the rule in other castes. The Aradhyas adhere to the braminical rule, but the other castes of lingadharis often let the wedding or betrothment take place after the bride is grown up. Like other Hindus they permit polygamy, if the first wife be childless. But the second nuptials cannot take place without her consent.

Marriage is imperative among Bramins. It is merely voluntary among the Jangams.

A widow is treated with every sort of kindness and respect. Her head is not shaven, and she is permitted to marry again.

The Bramins exclude a widow from society. There is no such prohibition among the Jangams: who however, agreeing with others of their fellow countrymen do not permit her to wear the jacket, perfumes, paints, black glass bracelets, the nose-ring and the silver toe-rings; for these form the specific garb of a wedded woman. But in various tribes of Lingadharis some of these rules are laid aside.

A woman of piety is just as fit as a man to confer instruction in the creed. The Jangams always receive and return the bow or salutation of every woman, just as happens between man and man. For, they observe, were we to offer her any insult it would be an insult to the image of the god which she wears. Nothing but a breach of chastity can lose her the title she possesses to gentle and honourable treatment.

On Sects in this creed: and rules in regard to Eating.

Though the Vīra Saivas declare themselves entirely free from the bonds of caste, we shall perceive that their liberation is but partial.

They cannot eat with any one who refuses to bless the food in the name of Basava: for they look upon others as heathens.

And they refuse to eat with an Aradhya, because being a Bramin he is an idolater in their eyes by reason of his prayer (gayatri) addressed to the sun. For the solar worship is an essential part of the braminical creed.

And the Aradhya, as he refuses to lay aside his caste cannot of course eat with men who eat with parias. Thus each sect is equally unwilling to admit the other to equality.

In other sects of Hindus, the Bramin takes precedency, and is allowed every honour. In this one he is looked upon as an inferior, and as only a pretender to being in the faith.

To this subject we must return when speaking of the Aradhyas:—meantime it is requisite to point out that the Jangams, who totally reject the Bramins, class themselves as *Sāmānyas* and *Visēshas*.

1. The *Sāmānya* or ordinary Jangam is bound by no vow. He or she can eat flesh* and drink wine: they use betelnut, and can eat in any one's house. Only they are obliged to marry in their own caste.

2. The higher grade, opposed to this is the *Visēsha* or extraordinary: being the guru or teacher, commonly called Matādhipati or spiritual guide. All the rest are his disciples. He or she acquires this rank by taking a vow, the *greater* vow; which will be afterwards described. Any man or woman who is moral and devout is admissible to this rank: which entirely releases them from caste.

Further there are two classes of (bhacts) "worthies;" who are devotees, but do not as yet aspire to the higher grades.

1. Those (*Sāmānya bhactas*) who retain caste, and in other respects are the same as Sāmānya Jangams.

2. The (*Visēsha bhactas*) confirmed worshippers: these are under the *lesser* vow: which binds them to honour the "Guru, the Lingam, and the Jangam"—three phrases which they use as a summary of their opinions. For they ordain that every honour must be paid to "the teacher, the image, and the brother in the faith." And their bitter foes, the Bramins, acknowledge that the Jangams treat each other as brethren.

These *Visēshas* are entirely free from caste: and as they are found chiefly among the Cannadis, they are generally styled *Cannadīlu*.

Now as to eating:—the *Visēsha bhacta* will not eat in the houses of the lower sect. The Guru can eat in the houses of *Visēsha's* alone: who are entitled to sit with him at dinner. The rest cannot; they therefore sit a little way off. The distinction is that the *Visēsha* Jangams are teachers: and the *Visēsha* Bhactas are disciples.

All can eat in the house of the Visēsha, but *not in each others* houses.

These rules apply to both sexes: for men and women dine together.

Though the Aradhyas are bound to attend funerals, even those of parias, the Jangams (even parias) cannot eat with them even at the funeral dinner.

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* Excepting of course that of the cow, which all Hindus look upon as we do upon horse-flesh.

I have mentioned that they bless their meals in the name of their god. The food is polluted if "a heathen" casts his eye upon it *before* it is blessed. But *after* the benediction is uttered they consider the food holy and are bound to eat it: it cannot be defiled by the glance or the touch of any person. Dining is termed *Siva puja*, or worship. For they think, with JEREMY TAYLOR that "God esteems it a part of his service if we eat or drink: so it be temperately and as may best preserve health."

On the Pandarams.

The Saiva worshippers among the Tamils are called Pandarams: these are not Vīra Saivas, nor do they wear the lingam or adore Basava. I name them here chiefly because they are often mentioned as being Vira Saivas whereas in truth they are (like the Smartas) Purva-Saivas, and worship the image of Siva in their houses. In his Essay, Professor Wilson has regarded this sect as Jangams, and has also included under that title the "gangeddu-vandlu" or mendicants who rove about, leading a bull gaily tricked out. But these are mere *Dasaris* or mendicant friars of the Vishnu sect, and have no connection with the Jangams. These may always be known by the bell and the fan they bear, as well as by their elegant dresses and gay appearance. Another Vishnavite sect who are equally opposed to the Jangams are sometimes mistaken for them are the çâtânîs or Sartarnees who call themselves Vīra Vaishnavas. These men lay aside caste but are earnest devotees of Krishna, and accordingly are the firm allies of Bramins.

On "Guru, Linga, Jangam."

These three words comprize the creed of the sect, and evidently were intended to disavow every part of the braminical priestly tyranny.

This mystic phrase is thus expounded. The image (lingam) is the deity: the Jangam is the wearer or fellow worshipper: and he who breathes the sacred spell in the ear is the Guru. Thus he supplies the link between the god and the worshipper, and ever after is looked upon with affection as the true parent: even more respected than the father according to the flesh. For, says the Jangam, I am one with the deity, and he alone is my father who conferred this unity on me.

Among Aradhyas the father himself usually confers the spell: in other castes it is thought improper to be the disciple of one's own father or mother.

The Gurus being devout persons usually separate from secular employment, subsist on alms or free-gifts. But it does not seem to be a duty to support the guru, or to consult him, and own his authority in ordinary affairs. It is the duty of the Jangam to support and be a son to the guru or father confessor: but the guru never asks alms of those who are not in the creed. Several gurus are employed as paid tutors or clerks among the English, and of course receive wages: which would be unlawful were the employer a Jangam.

These rules regarding initiation are analogous to those used among Musulmans, wherein the teacher is called Moorshud, and the disciple (man or woman) is a Mooreed. The ceremonies used on that occasion are fully described in Dr. Herklots's " Customs of Musulmans," page 282. In each faith love of God, and benevolence towards brethren in the faith are the proposed objects.

Regarding the Aradhyas.

In other sects of Hindus the Bramin uniformly takes precedence of other castes. But among the Vira Saivas he is degraded beneath all others.

Hence there is a perpetual feud between the Aradhyas and the Jangams who (unless at funerals where all are bound to assist) treat these Bramins with contempt.

And as a reason for such behaviour they allege that the Aradhya is an idolater because in assuming the sacred thread he is obliged, in common with all Bramins, to offer adoration to the sun, whereas Basava ordained the worship of God alone.

The Aradhyas also give great offence by affecting a superiority over other castes. The Jangam is bound to be courteous to all: especially to fellow worshippers: and return a woman's salutation or bow just as heedfully as that of a man. But the Aradhya calls himself a Bramin: he salutes none but Bramins, and looks upon none else to be *Jangams* or brothers in the faith. He will not pay more honour to women than other Bramins do. In fact women are not much better off among Aradhyas than among other Bramins. If her husband dies a woman cannot marry again. Certainly her head is not shaved nor is she expected to die with her husband, but even this rite has been very reluctantly laid aside, and some Aradhyas have honestly confessed to me that they much regret the prohibition.

The rites of *prayaschittam*, and other sorts of purification and fasting, are as severely binding on the Aradhyas as on other Bramins. They assert that they religiously adhere to the carma canda, or ceremonial law. But they fail to establish this to the satisfaction of a Bramin.

Another point in which the Aradhyas widely differ from Jangams is their refusal to admit proselytes into their creed.

In the points now described it is evident that the Aradhyas have very reluctantly and imperfectly obeyed the laws given by Basava, who seems to have treated them leniently, admitting them into his creed in the hope that after a while they would be prevailed upon to lay aside the sacred thread, and the worship of the sun which is connected with it.

In course of time many of them have done so: and a guru who is one of my principal informants, is the son of a Bramin (an Aradhya), who saw the folly of caste, laid aside the thread and became a Jangam, wherein his instructor seems to have been originally a paria. But being a Visesha Jangam, of course he now is wholly independent of caste. In Sanscrit scholarship, and particularly in a ready acquaintance with the Vedas he is decidedly superior to an old Aradhya, whom I also employed; who however, is well acquainted both with the Vedas and the Agamas. In the midst of a discussion one day on caste the old man laid his hand on that of the Jangam guru, and said to me, "Sir if I could only lay aside this thread I could go to this good man's house, eat with him, and marry my son into his family!"

In all these discussions I observed that the Jangam treated the Aradhya with kindness, and perhaps pity, but certainly with no respectful deference. A learned Vaishnavite Bramin was present at these discussions, and observed to me that the Aradhya being half Bramin half Jangam was completely placed between two fires: and every concession which in the course of argument he might make to one party enabled the other to disown him.

Indeed so great is the antipathy between Aradhyas and Jangams that they cannot even write to one another: as the ceremonious civility of Hindus would oblige each to use expressions of regard which his judgment or his antipathies would forbid.

According to the Basava Puran and other leading books the Aradhyas manifestly are unsupported in their claims to superiority. For all the various (bhacta) "worthies," or saints, whose faith and deeds are extolled, are parias or shoe-makers, hunters or weavers. Not one of them is a Bramin.

And if they claim rank in consequence of Basava's having been the son of a Bramin this avails them nothing: as he laid aside his caste and became the willing servant of parias. In fact the Aradhyas being only half converts resemble the "Christian Bramins" we meet with at Madras, who are baptized, but continue to wear the braminical thread, and

are as much bound by caste as other Hindus are. Yet they are sin
believers in Christianity, and express a horror of idolatry.

Lastly it remains to speak of " the four Aradhyas" visionary per
ages of very great importance in the creed, but regarding whom I
not succeeded in obtaining any definite information.

Among Jangams as well as among Aradhyas, at all their variou
lemnities whether marriage, birth, initiation or funerals, four vas
water are solemnly placed in the name of " the four Aradhyas'
prophets.

These four sages are named R'EVAN Aradhya, MARUL Aradhya, I
RAMA Aradhya, and PANDIT Aradhya. In four ages, it is said, th
four successively appeared as precursors of the divine Basava.

And to this slender information only one point is added which is
source of perpetual contention. The Aradhyas claim these sage
being Bramins: which the Jangams deny, saying, these were our o
nal teachers, and could not have disobeyed Basava who abolished c

The Aradhyas and Jangams who answered my queries, how
frank in other respects are evidently in total ignorance about these
nerated characters, who are spoken of in no book that I have met w
The Pandit Aradhya Charitra is named after the fourth prophet,
is merely written in his name, and is acknowledged to be a modern c
pilation.

The Siddhanta Sikhamani, written in Sanscrit verse on the Ara
system contains a wild mythological tale tending to represent R
Aradhya as a human appearance of one of the Pramathas or ministe
Siva. But this book is not considered good authority, and the leg
is not current. I am also assured that the details are given in a b
(supposed to be written in Canarese) named *Chatur matha Sthala* n
nayam, but I have not met with this book, and my informants know
it only by report.

Perhaps we may reasonably entertain a suspicion that these "
sages" are analogous to the four *peers* of the Musulmans, who are
cribed by Dr. Herklots, in page 287 of his volume already quo
These *peers* or canonized spiritual guides certainly bear Musul
names, but they play the same part, in the ceremony of makin
Musulman *mooreed* that the four Aradhyas do in that of making a J
gam. They too, are described in an apostolical succession, and
crown the analogy, nothing satisfactory can be ascertained regar
them, notwithstanding the high veneration in which they are h
De non entibus et not apparentibus eadem est ratio, and if these
sonages ever existed among the Jangams, how does it happen that th

four alone, of all the saints, are designated as Aradhyas? I confess that neither the Jangams nor the Aradhyas approve the solution I have here offered, and a decision more satisfactory may perhaps be elicited by further enquiry.

Regarding the Vedas.

It has been stated that the Aradhyas found their pretensions on the Vedas, which as they assert prove their authority as Bramins. To perceive the true value of these claims it may be as well to state the present practice regarding the Vedas; and the following statements are the result of many enquiries, as to the rules prevailing in the Telugu and Tamil countries.

Only a small portion of the Vedas is generally read among Bramins: it is read without the meaning being explained, and is in obsolete Sanscrit. The great rite or sacrifice called yajna is occasionally celebrated among the Smārta Bramins: but this is so rare that my informant never heard of but two instances. The few *Bramins who live by the Vedas* commit twenty or thirty chapters to memory, which are recited at certain ceremonies in weddings, funerals, and yajnas. They never pretend to know the meaning. Ordinary Bramins though taught a few pages of the Vedas at school are not expected to retain this knowledge. From the best information it would seem that not ten Bramins might be found throughout the peninsula who are really skilled in the Vedas. Those recluses who study divinity read various commentaries called *Bhāshyam.* The Smartas read the Sancara Bhāshyam. The Vaishnavas read the Rāmānuja Bhāshyam: and the Madhavas read the Madhva Bhāshyam: each man reading the commentator approved by his sect. Such readers are very few indeed. No man concerned with secular affairs troubles himself with either the Vedas or the comments. So great is the veneration shewn to Sancar Achari that the other commentators even when they oppose his explanations do not venture to name him. Thus we see that the Bramins themselves know just as little about the Vedas as the Musulmans do about the koran.

Among the Jangams and Aradhyas certain *portions* of the Vedas *with the explanation* are much dwelt on. But these are selected for sectarian purposes: to demonstrate that Bramins are in error, and, on their own tenets ought to embrace the creed of Basava. By insisting on allegorical interpretations they pervert the meaning, and cannot very seriously believe what they allege. In fact this device resembles that of the commentator Hardouin, who attempted to interpret all th Odes of Horace so as to give them a Christian import.

The Aradhyas assert that they are followers of the Veda and t Jangams are (Veda-bahya) excluded from that code. The Jangam plies that all have an equal right to read the Vedas: but that Aradh have like other Bramins perverted the meaning of the text.

In fact the Aradhyas merely take refuge in the Vedas from the lemma in which they are placed by their tenets. Their pretensions superiority are confuted by the very books that teach their creed: the Lila as well as by the Puran and the Charitra.

On loss of Caste.

Caste is lost in two ways: by sin and by accident. A full Jang who breaks his vow by tasting wine or betel-nut is excluded from ciety: but on expressing due repentance his friends can agree to with him, and this completes his restoration: which however, is granted unless there is the strongest reason to believe he will he after be cautious. Instances of such loss of caste are extremely rare

Even if caste be lost the image is not taken away: for it is alw looked upon as a part of the body, and they can no more remove image than they can cut off the man's hand.

No case is known of the image having been voluntarily laid as Accordingly the Jangams declare that no one of their brotherhood ever embraced the Christian, or the Mahomedan faith.

If caste is accidently lost, prayer and solitude, they say, will resto it.

But they look with horror on the chance of any one accidentally losin the image hung on the neck or arm. They affirm that this has som times happened: and of course the loser is instantly devoid of caste.

Now when a person accidentally loses caste among Bramins or oth Hindus, the rest immediately turn upon him as fish or savage beas do on a wounded member of their communities. Their cruel treatme of the sufferer is remarkably opposed to the gentle temper of the Ja gam rule. For the Jangam custom obliges them to commiserate th sufferer, to fast and pray with him, until the lost image re-appears his hand "descending through the air like a bee." An Englishm refuses his belief to the stated recurrence of such a miracle, but bot Aradhyas and Jangams unite in assuring us in the strongest terms this miracle having repeatedly occurred; and they go so far as to de clare, that their faith rests on this marvel: and were it ever know to fail, their faith would perish.

On being asked how they would treat the corpse of one who died in such a deserted state they answer that it is a case that never happened, and they cannot say what must be done. As for his soul they suppose but very doubtingly, that it has forfeited immortality and must undergo the Hindu metamorphosis. The same also they say regarding the soul of an infant were it possible that it should be buried or lost in the sea without the performance of this solemn initiation.

Whether the person who has lost the image be an Aradhya, a guru, or a common paria, all castes, including Bramins are bound to unite in the rite of restoration just as all must unite at a funeral.

Regarding their Books.

The books read in this sect were originally written in Canarese, and are of two descriptions. Those universally popular as the Basava Puran and the Prabhu Linga Lila: and those peculiarly intended for Aradhyas, as the Pandit Aradhya Charitra. They generally speak of these three books as "the Puran, the Lila, and the Charitra."

The Arādhyās are very fond of Sanscrit reading: the Vedas, the Gīta (or Bhagavad Gīta), the Nilacantha Bhashyam, the various Agamas and the writings of the celebrated theologian Sancar Achāri, regarding whom the reader is referred to Professor Wilson's Essay on Religious Sects, Asiatic Researches, vol. 17, under the head "Dandis." These are eagerly studied but are not locked up from the people at large. For we shall find excellent Sanscrit scholars among the Jangam gurus, and many who are competent even to convey instruction in the Vedas.

They pretend to found their creed on the venerated Sanscrit treatises now named. But after long enquiry I find that their reliance on these is fictitious. It is easy enough for them to adduce certain texts from these books and the Vedas, on behalf of their creed,* and in particular in justification of their assuming the name *Jangama Lingam* or locomotive image of the deity. Orthodox Bramins laugh at their pretended proofs; especially at their claiming a right to give a secondary or spiritual sense to particular commands. For instance the *Yajna* or burnt offering ordained in the vedas is by them explained as alluding to "our passions which must be sacrificed."

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* We sometimes find a similar mode of argument in Christian writers. For instance in the VEDANTA RASAYANAM, a well known Telugu poem (in padya metre, in four books), written by Ananda, son of Mangala giri Timmaya, which is a little more than a century old. The beauty and poetical vigour of style exhibited in this work render it very attractive, but in the first book the learned author labours (as does the author of the Charitra) to confute Bramins and other idolaters on their own ground, adducing arguments from the Vedas and Puranas in support of his doctrine. Having omitted to mention this poem in a former essay I will take the present opportunity to describe it. The second book brings the history only as far as the birth of our Lord: having commenced with the Fall. The third gives a brief selection from the Gospels describing the baptism, the descent of the Holy Spirit (whom the poet, using Latin words, denominates *Sancta Spiritu*), the temptation, some miracles, particularly the raising of Lazarus; the Last supper: the departure to the Mount of Olives (which the author calls Nandana

Another step which gives Bramins no small offence is the plea set up by the Vira saivas to superior orthodoxy. For these hereticks assert that they merely revert to the primæval faith which the Bramins have perverted, and they very benevolently try to recal the Bramins to the right way from which they have erred. In the Pandit Aradhya Charitra, the author has laboured to convince Bramins from their own puranas that they are in error and that they ought to embrace the Vira-saiva creed. Such ratiocination is absurd enough when we consider that Basava set out by entirely setting aside braminical authorities.

The Purana and the Lila were originally written in Canarese, and have been translated into Telugu and Tamil. It has also, I hear, been written in Mahratta, in prose as a catha or story. The purana is an amusing composition, and particularly pleasing to one who has read *usque ad nauseam* in the braminical books. The Lila is in quite a different vein and vastly superior. It is an allegorical poem of considerable beauty, and is particularly attractive from the pleasing manner in which it describes the female sex: neither as goddesses (as they are described in the braminical poems) nor as brutes, which is too often the style of the braminical puranas. It is not only amusing but written with such delicacy that any Hindu female might read it with gratification. The

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Vanam, as he names Peter *Rayapa*, from Rayi a stone. He calls James Yagappa, and John Arulappa. For martyrdom he uses *martura*). The betrayal of our Lord to the Jews concludes this book.

‡ The fourth book describes the crucifixion and subsequent events. The author now takes occasion to teach the doctrine of purgatory, for which he uses the Hindu phrase *pitru-locam*. This, and a few other passages, particularly the Salutations to the Virgin at the opening of the poem, shew that the poet was of the Romish faith. Then are described the Saviour's Resurrection and appearance to the Maries. The journey to Emmaus. Then follow brief accounts of the ascension, and the descent of the Holy Spirit. Then the beatification of the Virgin—Peter being left on earth as head of the Church. On the wrath of God and the intercession of the Redeemer. The Last Judgment—Conclusion, containing a summary of the points in the creed, with poetical version of the "ten" commandments. The writer has no where inculcated either the worship of Saints or the other peculiarities of the Church of Rome: at the same time he has courted the attention of Bramins by dwelling as little as possible on the distinguishing doctrines of Christianity.

This poem is written in a beautiful style, and though somewhat too learned for beginners will afford most valuable aid to the advanced student of Telugu poetry, and will spare him the tedium of learning the language through the medium of braminical books. He should *first* read the *third* canto.

tendency of these two books is thus discriminated. The puranam is the Bhacti cānda: or attributes every gift to the force of faith. The Lila is the jnāna cānda, or assigns wisdom to be the means of attaining future happiness.

The Chenna Basava Puran, the Mari Basava Puran, and many more Jangama legends found under various names in Telugu and Canarese (nearly all of which are to be found in the Mackenzie Library) do not merit much notice. They are free from the pride, cruelty and abominations that disgust the English reader in the braminical puranas, but are merely wild vagaries of which more than enough may be seen in the Basava Puran. With slight variations they all run in one strain: that a certain saint out of love to Siva vows to earn money in some particular mode, and he then bestows it on Jangams, and becomes their servant. Accordingly Siva appears to him, and carries him to Cailāsa. On other occasions a "worthy" cuts off his wife's hands or nose because she presumed to touch or smell flowers which he was about to offer to the lingam in adoration: Siva as usual appears, heals her, and carries the pious pair to Cailas. There are miracles in abundance, and some of them very entertaining.

There are other volumes inculcating the yoga system (tatwa bodha) which to our ideas is strange bewildering nonsense. Herein there is but one system, common to all, whether Bramins or their opponents. For this unmeaning mysticism pervades every sect of the Hindus, and is analogous to the Sūfi reveries known among Musulmans,* and to the mysticism promulgated in France and Germany by the followers of Bourignon and Swedenborg. To lose one's senses (*cum ratione insanire*, as Terence says) seems to be its highest aim. Hindus who pretend to learning are fond of dealing in these idle topics, for the purpose of astonishing their hearers, but we shall find that their stock of phrases is soon acquired, and their fund of ideas is yet more slender.

The great theme perpetually reiterated by the Jangams as well as by all the other followers of the reformer SANCAR ACHARI is the resolving our body and mind into spirit. That the *atma* (soul) *is to* BE

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* Vide Malcolm's Persia, vol. 2, chap. xxii. and Sir William Jones's Essay on Mystical poetry. See also Extracts by Sir William Jones, from *Baxter* in the Madras Journal, for October 1836, p. 448. In Telugu the favourite work on the Yoga Sastram is the Vasu Deva Mananam. It does not appear that Basava encouraged such reveries.

This mystic science is indeed an unfathomable profundity of nonsense, such as we may find in the Rabbinical Targum. (Vide Schœttgen and Adam Clarke on 1 Cor. xv. 44). In the Siddheswara Satacam (lately printed in Telugu), and other volumes of devotion, the soul as a female addresses the deity as her lover and husband: as is often the mode of address used among the Persian Sufis (vide Madras Journal, vol. 5, p. 129).

the linga and thus to become one with the deity. This favourite theory is in its ulterior consequences destructive of moral responsibility, for if men become the deity, he of course is sinless, and they are accordingly absolved from sin.

It must be acknowledged that we no where find Basava inculcating this doctrine. It certainly forms the concluding lecture of the Lila: but that is a work not pretending to authority, but recording the opinions received in the national philosophy. This shews what pitiable ignorance Hinduism is in its highest flights. For they all acknowledge the *yoga sāstram* to be the great means of obtaining oneness with God.

It is clear that the Jangams are inconsistent enough in their belief: for while they condemn the Bramins as misrepresenting the truth, they are fond of perusing the various saiva legends wherein of course Siva and Pārvati are the deities, and there is no mention of Basava or his disciples the Jangams.

The most popular of these poems are the Calahasti mahatmyam or legend concerning the pagoda at Calahasti: the Bhallana Charitra wherein a king gains a blessing by making a present of his wife to Siva who visits him in the guise of a Jangam! and who thereupon as usual, carries both of them to Cailāsa! the Vira Bhadra Vijayam the Bhanumad Vijayam, the Madhura Puran also called Halasya Mahātmyam or Socca Natha Lila (a high flying Aradhya work), the Bhanumad Vijayam, and a few more saivite legends.

They sometimes claim the poet Vemana as preaching their creed but though he evidently held the Bramins in detestation, and shews a partiality to the tenets of Basava, he does not embrace the Vira Saiva tenets. The insulting manner in which he speaks of the female sex furnishes another proof that he could not be a Vīra Saiva. He also speaks of future transmigrations: but the Jangams believe transmigration to have terminated.

But these remarks on their literature cannot be concluded without a few observations on

The Tantras.

Bramins frequently allege that the Jangams are a depraved sect who are guided by the Tantras or heretical books. But we should not incautiously believe this. The Jangams are in all respects opposed to licentiousness, which is the main spring of the Tantras. The Jangams came from the west. The Tantricas from the north. The Jangams adore the linga and abhor Maia the goddess of Delusion (Venus or Cali, as Devi), who is expressly the goddess (Yoni, or Bhaga Mālini) of the Tantricas. The Tantricas take no notice of the lingam: they adore Betala (the devil), and other malevolent powers. The Jangams honour Siva as Daxina Murti or the beneficient and loving deity. The Tantricas say they aim at a perfect release from fleshly lusts. The Jangams do the same. But the former, being hypocrites pretend to yield to their passions as the path to freedom. Whereas the Vira Saivas call on their votaries to deny themselves in all respects. They attend especially to the rules concerning funerals, marriage, and placing infants in the creed. On all these points the Tantras are silent. The Tantras inculcate the use of flesh, wine, magic and debauchery, the Jangam creed abhors these. The Jangams are an avowed sect; the Tantricas assume the guise of Smartas. The Jangams train up their children in their creed; the Tantricas (like the Arreoys in older times in Tahiti) merely admit proselytes. The Jangams are sober, devout and humble. The Tantricas are debauched, atheistical and proud. The Jangams are rigid puritans: the Tantricas are licentious atheists. Herein their depravity resembles that of the worshippers of Isis in Rome, the "*Socialists*" of modern days in England, the St. Simonians in France, the *Illuminati*, and other *philosophers* of Germany, the followers of Cagliostro in Italy, and the Nessereahs at Kerrund in Persia.*

With a few touches of his felicitous pencil, Shakspeare has given a view of their system, or *philosophy* which is the Sacti Puja or Worship of Power.

> " Thus every thing includes itself in POWER :
> *Power* into will :—will into Appetite:
> And Appetite, an universal wolf,
> So doubly seconded with Will and Power
> Must make perforce an universal prey,
> And, last, eat up himself."
>
> TROILUS, I. 3.

Again, (Anthony and Cleopatra II. 1.)

> " Let witchcraft join with beauty, lust with both :
> " Tie up the libertine in a field of sweets
> " Keep his brain fuming," &c

Indeed the sottish aspirations of Gonzalo (Tempest, act II, scene I) give a summary of the bacchanalian rites taught in the Tantras. And if the reader has any curiosity regarding their system of magic, he will find it in Dr. Herklots's English translation of the Canoon-e-Islam or customs of the Moosulmans of India.

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* Regarding the Nessereahs, see Buckingham's Travels: cited in New Monthly Magazine, 1829 p. 209.

Knowing the deserved odium that attaches to the Tantras, Bramin assert that these constitute the Jangam system. But were this the ca how does it happen that the Tantra volumes are found only in the po session of Bramins? The fact is that both parties read the Tantr from motives of curiosity just as a protestant might read the Kor without in any point adopting the Mahomedan faith. The Jangam honestly avow, and vindicate all they do, they have no motive for co cealment. The Bramin acts on an opposite principle and assures that the Jangams are a depraved and senseless set of hereticks, who obe the levelling principles of the Tantras, and pay honour to the vile castes. But two widely different principles govern them. The licen tious Tantricas reject caste because it is an ordained rule of society: h degrades all men to the brutish level. The Jangam is no leveller: h indeed desires to abolish caste: but by raising from the lowest grad those whose faith shews them to be good men. Indeed the imputatio made against them are very similar to the infamous stories circulate among ourselves, in older days against the Puritans, the Quakers a Moravians,* and investigation has shewn them to be equally false.

It is to be observed that no instance is known of a Vira Saiva acti on the principles laid down in the Tantras. To excuse their aptn to read these abominations they allege that the Tantras belong to th creed because they describe Siva as the great deity, and countena as Basava does, the abolition of caste. These are but slender apolog for such an imitation of the evil example set them by Bramins.†

In concluding these remarks on their literature, we may add t the Jangams have no objection to read and study any part of the B gavat or other braminical books: only they refuse to accept them divine and authoritative.

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* See Southeys Life of Wesley, vol, 1. p. 359.

† The Minda Jangamas or Bachelors are spoken of in various passages of the Ling dhari poems. They are confessed to be libertines but are devout. They have inte views with (Vesias) courtezans who are likewise devout!!

The following is the received opinion. The Jangams are entirely forbidden to ha intercourse with prostitutes: but among the earliest proselytes were some unmarri men, who were permitted by Basava to have intercourse with courtezans who, belong to the sect. These men were called Minda Jangams or libertines, and in the prese age there are none; for all are bound either to marriage or to virtuous celibacy That Basava permitted this is only a theory, and rests on no proof.

In the western districts there are prostitutes who are called *Basvinis*, and are said to be thus devoted by their parents, on their lives being in danger through illness in infancy. Some of these are, as I am informed, daughters of Jangams: but all are not so: being children of Hindus of other castes. I have heard of some Jangams in similar cases attempting to remove a child's illness by giving it a braminical name, with a view to appease some god or goddess, whose displeasure is imagined to have caused disease

These statements certainly shew the purity of the creed not to be so complete as its devotees assert.

On their belief regarding the Deity.

In all the various creeds that exist among the Hindus, they profess to adore one only God, and represent him as appearing under various names. Thus in the Vira Saiva creed, they profess a belief in SADA-SIVA alone as the supreme being, who is invisible but pervades all nature. They frequently speak of him as DAXINA MURTI or the express form of goodness, who descended on earth under the name BASAVA and likewise as ALLAMA. The following Sanscrit hymn or prayer to DAXINA MURTI was written by the celebrated divine AGASTYA: it forms part of the *Agastya-ashtacam*, and is prefixed as a motto to the Prabhu Linga Lila:—

1.

Bramh ānandam, parama sukhadam kēvala jnāna mūrtim,
Dwandw ātītam, gagana sadrisam TATWAM ASI *yādi laxyam!*
Ecam, nityam, vimalam, achalam, sarvatas sāxi bhūtam,
Bhāv ātītam, trigunā rahitam, sad GURUM *tam namami!*

2.

Vata vitapi samīpē, bhūmi bhāgē nishan'n am
Sacala muni janānām, jnāna dātaram ārāt,
Tribhuvana Gurum, I's'am, DAXINAMURTI *Dēvam,*
Janana maran'a duhkha xēda daxam namāmi.

1. *I salute the great teacher, the bestower of divine happiness and supreme bliss; the image of perfect wisdom: who is removed f om all griefs; who is represented by the sky; who is denoted by the* "TRUTH" *and other names. The one, Eternal, stainless, stable, and Omniscient, the incomprehensible: who knoweth neither Passion, Partiality nor Folly.*

2. *He who sits on earth at the foot of the fig-tree*:* *who bestows wisdom on all the devout hermits who surround him: Lord and teacher of the universe, the God who is embodied Goodness, him do I salute as the releaser from the bonds of life and death.*

When the deity is spoken of as invisible he is named Siva, Sadā Siva, Paramesa, or The Supreme Being. When described in a visible form the name is Daxina Murti or the image of Grace. When described as on earth, Allama is the usual name: though this is declared to be only another name for Basava.

* The *vatá vrixam*, the banyan, or fig-tree is the Hindu emblem of immortality: they believe that in the end of time all nature will perish except one mystic fig-tree at the foot of which, the deity will be enthroned.

Thus we see that they look upon their leader as a divinity: imit ing the Bramins who have exalted their heroes, Krishna, Rama a Hanuman, into gods on earth.

The vague manner in which these names are used produces so inconsistency. Thus Basava *is* actually Siva: vastly superior to t mere Siva or Jupiter who is the spouse of Parvati: and yet is sent earth by him. He is born as Basava, then appears as Allama, is ador as Daxina Murti: and then we have interviews between these perso ages, whereat Basava offers adoration to Allama.

It is observable that Basava's wife Gangamba, is never supposed to a goddess: nor does she receive any homage.

Sancar Achari, the great theologian of the Smartas having declar that ONENESS with the Deity is the great object, the Jangam repli that this union is attainable in this life, and that every true Janga has attained it. Moreover he asserts that his mortal body is a me member of the image he wears. For, says he, "what am I in th hands of the God who dwells on my breast? *I am earth, he is spirit I am but a part of him.* We find similar language among som philosophers of Greece and Rome. Thus Livy (lib. xxi. 5,) say *Vidit enim quod videndum fuit* APPENDICEM *animi esse corpus, nihi que esse in eo magnum.* In fact the Bramin looks upon the body a all in all; the Jangam does not. Yet the regard in which they hol the *yoga sastram,* which wholly depends upon the *bodily* frame, an pretends to spiritualize it, is a manifest inconsistency, and forms a additional proof that all the Hindu systems of devotion in their highe flights betray the weakness and blindness of unassisted human natur

Though this creed utterly condemns all worship paid to Siva an his spouse Parvati (Jupiter and Juno), still these personages and the attendants (Nandi, Bhringi and others) are familiarly introduced i the Jangam poems. This odd inconsistency is analogous to that w meet with in Addison, Prior, and the French school of English poets who introduce Jupiter, Venus, Cupid and Mars, as if they really believed the existence of those demi-gods. When questioned on such a hal belief in the Hindoo theogony, the reply made by a Jangam is no satisfactory. He does not look upon such poetical machinery as inconsistent with his creed. For, says he, all of these are very possibly gods or powers of various degrees of might, and we are not bound to believe a word of the stories regarding them. We adore "Sadā Siva" (the ever blessed) alone, who is known under the name Basv Esa (the lord Basava) or Allama Prabhu (Lord Allama) who came on earth to found the Vira Saiva faith, or rather to restore it to primitive purity.

Considering that this creed arose in the west of India, in a country bordering on that inhabited by the Syrian Christians, it has sometimes occurred to me that very possibly some of the tales regarding Basava may have been borrowed from legends current among the Syrian churches. Both chronology and geography seem to strengthen this suspicion: and it is worthy of notice that the name Allama, which resembles the Syriac and Arabic name of God is attributed by them to their deity. The word Allama seems to be foreign, and in their eagerness to account for it, the various poets, whether Sanscrit, Telugu or Canarese have adduced roots which will not bear enquiry. Indeed the learned men who assisted me in the present investigation have acknowledged that the etymologies adduced are strained and improbable. They however, would by no means admit my suggestion that this name originated in Allah: and particularly observed that no Jangam had ever been known to embrace Christianity, or the Mahomedan faith.

Yet when we consider how determinately Basava did every thing in his power to oppose the braminical opinions, I confess that his followers thus borrowing a well known name of the deity from a neighbouring country seems not improbable. He ordered *all* children to be introduced into the religion when young. He abolished burning the dead and substituted burial: he set aside the priestly descent, he permitted widows to marry again. In these and many other points equally opposed both to Bramins and to Jainas it appears to me that he attempted to follow the customs of Christians. In particular it is observable that the Jangams reject the observance of new moons and full moons but consider every Tuesday a sacred or blessed day.

If it prove true, as just now mentioned, that there have been no converts from this creed to Christianity, we may fairly attribute it to the neglected state in which the English have left the Jangams. That neglect seems to be the result of the disgusting slanders with which the Jangam character has been blackened by Bramins: who usually are an Englishman's informants on all subjects concerning Hinduism.[*]

If the Jangams really were the depraved and vile race the Bramins describe them to be, it surely might be expected that they would have become notorious in our courts of justice. But there we do not hear of them. And surely it is much to their honour that their conduct is not known to be such as makes it a subject for police investigations. Another reason for their never appearing in our courts even as complainants or witnesses is, that we have forced them (until the present day, this necessity being now done away by law) to take the common Hindu oath: which they look upon as a crime. Among themselves the oath commonly used is, to make the requisite assertion while holding the image in the hand. Or else, to lay the hands on the feet of any Jangam. For, say they, every Jangam is a living image of the god we adore.

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[*] As one proof that the Jangams are not more unwilling than other Hindus, to listen to Christian doctrines I may mention a poem written in the Telugu dwipada metre, intended to convey a version of the Gospels. This is the composition of a learned Jangam poet, and having seen but a small part of the work, I can only state that it seems to be well executed in a plain unpretending style. The title is KRISTA CHARITRA, and in writing it the author appears to have been guided in his phrases by the Tamil version of the Gospels written by FABRICIUS.

The Vīra Saivas illustrate their creed by a comparison quite in the Hindu style. They say, the guru is the cow: whose mouth is the Jangam or brother in the faith; and the lingam or image is the udder. The cow benefits its owner by means of the udder: but what fills the udder? the mouth. And what connects the mouth and the udder? the body. Accordingly if a Vīra Saiva wishes the image to benefit him (that is, if he desires to obtain the favour of the deity), he must "feed the mouth"—that this, sustain and comfort his brethren. And then the blessing will be conveyed to him by means of the teacher. Accordingly the Jangams blame the Aradhyas for neglecting this command, and ask how they can expect the image to nourish them if they neglect to sustain brethren and fellows in the faith. For the Aradhya refuses to look upon any but Aradhyas as brethren.

The strangest part of their legends regarding Siva is that wherein he is represented in the most contemptible light as completely the servant of various (bhact) worthies or saints. Such stories abound in the Basava Puran but are excluded from the Lila. In these we are reminded of the Romish legends wherein the Virgin Mary, and some other personages are represented under most degrading circumstances, as obeying or waiting upon the saint whom the legend extols. Thus in the fourth book of the Basava Puran is a story of a certain "worthy" (bhacta) named Nambi, who by force of faith got Siva so completely into his hands that he employed the god as a mere slave. In another story one of the "worthies" scolded Siva who "was so much alarmed that he slunk round the other side of the image, and ran away into the jungle." Other stories represent this paltry demi-god acting either as a thief or as a receiver of stolen goods, to protect his adorers: and they frequently represent him as acting the part of a pander, at the bidding of one of the worthies.

The Vīra Saivas evidently look upon such stories as excellent jokes, and certainly many of the tales are incomparably more amusing as well as more moral than the dulness of braminical purānās. But when they are asked how they venture to represent their god in this ludicrous manner, they reply at once that this is not their god: their god is ALLAMA BASAVA; the one Sada-Siva (ever blest), whereas the hero of these stories is merely the braminical Siva whom they think as fair a subject for merriment as Jupin or Jupiter is in the French theatre.

In apology for these stories Jangams allege that they all establish the necessity of faith (bhacti) as the great means of attaining happiness and miraculous power. "As the Bramins, say they, call themselves (bhu-sura) gods upon earth we will shew that our *worthies* (bhact) are quite a match for them." Accordingly there are many legends to prove that (Janga-prasadam) food or the *leavings of food* blessed by a *worthy* can perform all sorts of miracles. For instance, a Bramin who by a curse had become a swine ate what a Jangam had spit out and hereby resumed the human form. Elsewhere a Jangam's shoe works miracles.

In all hagiology we find that the fables invented in successive centuries become gradually more marvellous. Accordingly though the legends of the Basava Puran are wild enough they are out heroded by those of later date: for instance, the Chenna Basava Puran, from which (book 2 verse 86) I cite the anecdotes now mentioned.

It must however, be acknowledged that in a redundancy of nonsense as well as in dirt the Bharata beats all the Saivite stories. There we find the very sublime of puerility: braminical legends compared to which *Jack and the Bean Stalk* are nothing at all. And all this is enshrined in a flow of beautiful Sanscrit verse which for richness of expression and harmony rivals Homer himself. The Bramins have had possession of the most perfect and beautiful of languages, and have often perverted its melody and vigour to the vilest of purposes.

Objectionable as many of the Saivite* legends are, they are purity itself when compared to the braminical writings. The great prophet of the Bramins is VYASA, and this venerated Saint's description of his own miraculous birth is a master-piece both of filth and folly.

The Jangams are indeed set free from believing such legends but their own hagiography, though not dirty like that of the Bramins, is full of absurdities: in apology for which they acknowledge that many of these tales bear marks of fiction.

Further, they allege that in all these legends the adorers are not

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* I ought to have already mentioned the *Siva Puran*—of which the reader may find an abstract under that title, in *Rees's Cyclopædia* (furnished by Sir CHAS. WILKINS); and he will perceive that this book has nothing to do with the Vira Saiva Creed. This puran is *entirely forgotten*. I possess one copy in Sanscrit and never could discover another.

Vîra Saivas. They are Jainas or else ignorant followers of the braminical follies: but that by the force of (bhacti) faith and charity they ultimately were "admitted into heaven" (literally, borne to Cailasa) which, as they assert denotes admission to the true creed.

In many of the legends we may trace a similarity between the character of Basava and that of Mohammed as described in the various legends current among Musulmans: shewing much simplicity on the part of Basava the master, and a voracious credulity on the part of the disciples. Those Mahomedan stories however, contain many incidents of the most disgusting kind: from which the Jangam books are entirely free.

There is so remarkable an analogy between the Pythagorean *Mon*[illegible] and the deity of the Jangams that I cannot well avoid adducing the following brief deduction from the philosopher's statements, as represented in Cudworth's Intellectual System, 2d edn. 4to. chap. iv. p. 37[illegible] 376.

Pythagoras calls the four principles by numerical names; the Mona[illegible] Duad, Triad and Tetrad. The Vîra Saiva calls them by specific name[illegible] viz. The Lingam, Bhacta, Guru, and Sivam, *i. e.* the deity, the d[illegible]ciple, the teacher, and supreme spirit: which pervades and unites [illegible] three.

The subordinate beings (gods, heroes and demons) of Pythagoras [illegible]swer to the Vîra Saiva saints: all of whom are supposed to be em[illegible]died forms of the prime existence or Lingam; which answers to [illegible] Monad: who is also Zeus. The Duad is the passive principle; or [illegible]*ciple;* he whose mind is the field for impressions. The link betw[illegible] these two is the third principle; the Guru or teacher. In his crea[illegible] office the deity is mingled with nature by Pythagoras and IS all natu[illegible] in the creed of the Vîra Saiva.

Love was the first Orphic principle, and so it is throughout the Vî[illegible] Saiva creed. Yet it is a created being; for it is a form or appearance o[illegible] the deity. Thus the Lingam and the Sivam, being the first and fourth[illegible] principles are one and the same. The Monas and the Tetractys are one.

Again—The Satwa guna being the characteristic of God; the Tamo gunam is that of man; and the Rajo gunam being the connecting link—the supreme state is *Nirgun'a,* or indescribable: which is the fourth or superior deity designated as the incomprehensible and ineffable Tetractys.

Then Monad signifies the prime or independent Lingam, and in its applied form it is *element.* Accordingly *Tejo Lingam* is fire, *ab-Lin-*

gam is water, *prithvi Lingam* is earth; in like manner *pul-Lingam* in grammar is masculine, or the male *element*, and *stri Lingam* is the female *element* or the *feminine gender.*

Some very obscene stories regarding the origin of the Lingam have been printed by various European authors. Those stories *(with which I never met in Hindu authors)* are perhaps braminical; they have nothing to do with the Jangams; in their books there is no mention of the subject; and I have not met with any Jangam acquainted with those fables.

Regarding Allama.

Allama is represented as becoming visible on the wish of Siva—he then descends on earth. There is no tale of his birth, death or final disappearance: and some Vira Saivas evidently believe he is still roaming the earth. In the Lila he appears on one occasion as an Adonis, to enamour Maia. Then disappears and visits a (bhact) worthy in a distant town: again vanishes and visits another: assumes no pomp, has no followers, and manifests no power. Basava is a ruler, a warrior, a king's minister, the head of a family, and fervent in his vows to nourish Jangams (puritans) and to vanquish Jainas. Allama's disposition on the contrary is marked with peace, benignity, humility and gentleness. Precisely in this strain do Mahomedan authors speak of our Lord, and unless he had heard such traditions it appears to me impossible to account for a Hindu poet's framing a character like that of the ALLAMA described in the *Lila*, so remarkably opposed to human nature as seen among Hindus.

Allama is represented as entirely chaste, though perpetually sought in love by Maia and other heroines. He remains unmarried. He has disciples but no relations.

On certain Shrines.

Though the Lingadhāris deny the sanctity of any particular place, the Aradhyas have yielded to the Hindu propensity to worship in certain places as peculiarly holy. Each of these is a temple to Siva and accordingly the priest is a Saiva Bramin. One of these at Canchi (Conjeveram), one at Jambukeswarm (near Trichinopoly), one at Arunagiri (Tirunamala), one at Calahasti (near Nellore), and one at Chidambaram. These are respectively called the lingams (bhūtams) or elements of earth, water, fire, air and ether. These are holy places frequented by Saivas; and the Aradhyas assert that to visit them is meritorious though the priests are Siva Bramins.

Regarding these temples the Jangams profess to have no opinion. They neither approve nor condemn him who worships there: for the sanctity of these shrines rests on the braminical purans.

They themselves profess to hold in honour five other lingams. 1. That of Chenna Mallikeswar at Srī Sailam. 2. That of Cudali Sangameswara, so named from the village where Basava died, or, as they say, vanished. 3. That of Gocarneswar, at a village of that name. 4. That of Bhīmeswar at Draxaram, in the Rajahmundry district. 5. One which is described in Professor Wilson's Essay and said to be at Benares but of this the accounts differ.

In these five places the priests are Jangams: not Aradhyas. At Srī Sailam Jangams pay nothing, though a fee of five rupees is exacted from every worshipper in the other castes (including Aradhyas). would seem that this was originally a braminical shrine, for there is image of Pārvati. This goddess, however, sits opposite to the image of Siva: and a Smārta Bramin is her priest while a Jangam is priest of the god. So heartily do these sects detest one another that the (tīrtham) holy water offered to one image is not touched by those who come to adore the other.

The Jangams acknowledge that they have no business to celebrate such worship, and in excuse say that these are customs derived from Bramins.

The odd conjunction of rival gods under the same roof, or at least within the same temple wall, is exemplified at the well known pagoda at Tiruvattoor, close to the town of Madras: where Siva is adored under the name *Adi-Pur-iswara*, "thus called (to use Homeric phrase among gods: but known among men as"—Teagarāya Swāmi. One corner of his pagoda has been taken possession of by a Sacti or *plebeian goddess*, called Tripura Sundari (Venus): but vulgarly *Vattapu-na[illegible]ehāru*. The god has a Siva Bramin as his priest, and has his spouse Parvati with him. But the Sacti or paria goddess (who is a much dreaded fiend) has for priest an *ōchē*-man: this is the Tamil name of a low caste, called *panasa* in Telugu, who are tumblers and wrestlers: and are employed to blow the trumpets at funerals. So degraded are they that no Sūdra will eat with them. The sacrifices he offers are buffaloes, goats and the like. This lady's feast lasts ten days, during which the luckless Siva and his spouse receive no worship. The doors are shut upon him and he is left alone till the feast terminates.

All Hindus, even those of the most respectable classes in the town of Madras flock to this pagoda, to gain the favour of these wretched idols: and there are miracles (well attested) in abundance to prove the benevolence and power of these divinities. The latest I have heard of is regarding a "worthy" who cut out his tongue as an offering to Siva, and the god restored it to him. This god's name, Teagaraya has become a proper name, given to many Hindu boys.

We are not to suppose that the Vīra Saivas approve of such brutal follies. They equally despise both the Siva and the Sacti, and much blame those of the Jangams who timidly follow the fashion in offering homage to this miserable Siva.

On Funerals, &c.

Some particulars regarding funerals have already been given. A few remain to be added.

The Aradhyas, as far as possible, adhere to the braminical customs: though they are obliged to use burial and not burning.

Over the grave the Jangams place an image of the lingam, to which they offer worship for ten days. They then remove it or leave it established, at pleasure.

On the eleventh day they give a dinner to the assembled friends, on whom they bestow new clothes, according to their means.

The Aradhyas believe that the father, grandfather and great grandfather of the deceased, who are in Cailasa *(heaven)*, enter purgatory (the *pitru locam*) at the time of his death: where they wear the appearance of his dead body. To these progenitors are performed the rites, called *ecoddishtam*, *nava srāddham*, *shodasam saptacam*, and many more. Some few use the rite of releasing a bull on this occasion, as other Bramins do.

Under the name of these progenitors the Aradhya guests are fed.

On the conclusion of these rites they say that the deceased is now gone to Cailasa.

But Jangams act in another manner, rejecting all notice of the three progenitors: for whose names they substitute the names SIVA, MAHESA, and SADA SIVA; which in fact are three names for God.

As a reason for this they allege that they consider the Guru to be the only parent of each disciple. For he bestows the image on them, and they are "*born in his hand.*" For, say they, being born into the faith is a more important event than that of merely being born on earth: and hence they pay reverence rather to the Guru than to the parent.

The image worn by the deceased is placed in his or her hand, and laid on the breast. They attribute to it the same potency that the

Greek Church attributes to the letter written by the bishop, and placed in the coffin.

They are free from the Hindu rules regarding the anniversary of a death. Some few, however, imitate Bramins in solemnizing that day.

Not having myself seen any of their tombs, I avail myself of the following note given me by Lieutenant NEWBOLD: "The tombs of Lingavants of rank are generally massive quadrangular structures, raised on terraces built of stone, and simply but handsomely carved. The interior consists generally of a square chamber beneath which is a vault containing the real tomb: which is also usually square. Over the head of the corpse is sometimes placed a phallus; often ornamented daily with sweet flowers. These tombs are sometimes constructed by Jangams for themselves; and an old priest living in a *mutth* among the rocks and ruins of Bijanugger, led me down into a subterraneous vault, dimly illumed by a solitary lamp: and this he showed me as the destined receptacle of his more mortal part. The bottom of it was strewed with ashes."

Ideas regarding a future state.

A modern writer describing the opinion of the Jews at the present day, on the subject of a future state, says "they believe that they suffer for themselves: Moses is their prophet but they look to their own good conduct as furnishing grounds for hoping a reward. If good, say they, "my God will reward me, and if bad he will punish me."

Such is the belief among the Jangams: who entirely differ from other Hindus with regard to a future state. They make a singular distinction regarding themselves. Other men, say they, are liable to transmigration, but we are not. All who are introduced into the faith are exempt from transmigration. They depart either to heaven or hell, and that state is eternal.

The Hindus in general are credulous enough as to ghosts, sprites and local demons. But they do not believe in the existence of the Devil or Satan as a separate being. In this the Vira Saivas resemble their countrymen. What we call the work or instigation of the devil the Hindus call, the fruits of a former birth. In the Christian poem "Vedanta Rasayan" the Devil is called *pisachi;* the same phrase (fiend) is used in our English poet CHAUCER.

The description of the *creation* of the world, forming a prominent part of the braminical system they have in opposition devised another mode, described in the Lila. Regarding the end of the world, they have no definite ideas.

On the Prayers used.

The prayers of the Jangams are addressed to the image they wear: which they salute as Basavesa.

The mantrās or prayers are borrowed from the Vedas: but they do not practise the (anushtha'nam) "mode" practised by Bramins.

The daily prayers usually are in the mother tongue. Occasionally they use a Sanscrit canticle: as the following, borrowed from Sancar Achari:—

Anāyāsēna maranam; vinā dainyēna jīvanam;
Dēhāntē mama sāyujyam curushwā Paramēswara!

"O supreme Lord, grant me an easy death, a life free from poverty, and eternal happiness* when I leave the body!"

Or they offer hymns of praise as the following, which is written in the common metre called *Malini.* The metre is broken in the fourth line; and though it might easily be rectified, they leave it as it is, the words being sacred:—

Nayana camala madhyé, jyōti rūpa pracāsam,
Prau'ava maya sabindum, prān'a-linga swarūpam!
Vihata janana pās'am, vighna vich-ch-hēda hētum
Hara hara Guru sāntam OM namas Siva'ya Lingam!

"Blessed image I meditate on Thee who dwellest between my eyes,
" in glorious form! who art the word and the sign,† the supreme being!
" Free me from the ties of the flesh thou who loosest every bond!
" O Teacher thrice blessed!"

Among Bramins the great mantra is the Gāyatri. This is used by the Arādhyas but the Jangams reject it, and use the *Panch-āxari,* or five-syllabled spell:—adding the shad-axari; or spell of six syllables; i. e. the Panch-axari with the addition of the word OM.

A celebrated verse says:
Vēda mátácha Gāyatri, mantra mātrā shad axari.

Accordingly in rejecting the Gāyatri they reject the Vedas, the Panch-axari or five syllabled spell, is "*Namasivāya*" or glory be to God. If the syllable om (like Amen) be prefixed "om Nama Sivaya," then it is called shad-axari or six syllabled.

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* Literally *Identification.* The Saiva creed describes eternal happiness as consisting in four (padavi) *points:* denominated 1, *sálókiam,* 2, *sámípiam,* 3, *sárúpiam,* and 4, *sáyujiam.* That is, 1 dwelling in heaven, 2 in the very presence of God, 3 bearing his image, and 4 becoming *one* with him.

† Here, as in a former verse, the Sanscrit scholar will not exact a more rigid translation: as that would require explanatory notes, and render the subject more tedious.

After thus addressing the image (in which rite they use the *rudra* or rosary) they make such requests as circumstances call for. Soc prayer is rarely used. Man and wife, though praying at the sa time, address their prayer to the image each person separately wears

The *prayaschitta canda* or *system of penance* is the most irkso burden imposed by braminical superstition and priest-craft. The small mistake or omission in performing ordained ceremonies, is herein c sidered as a sin, and atoned for by a vexatious system of fasting unmeaning prayer. The Jangams are set free from this rigid and poeritical system, but the Aradhyas have not had the courage to ob Basava, who laid it aside. They are nearly as much burdened with as are other Bramins.

On Rejection of Braminical Ordinances.

One important rule which Jangams observe forbids the use of special braminical rules. It runs as follows, in Sanscrit verse:—

> *Apasavyam, tilān darbhan n agnau carnám cha pārvanám*
> *Vikiran arghya pādyam cha saivas sapta vivarjayēt.*

"*Let the Saiva (which they declare to signify the Vīra saiva) de from the rites called* 1 Apasavyam, 2 tillatarpanam, 3 sacred grass the burnt sacrifice, 5 the stated observances called parvam, at the n and full moon, 6 the arghya, and 7 the pādya."

This verse is intended to sum up all the braminical rites which Vira Saivas renounce.

It is observable that the burning of frankincense is used am them, but this they say is no breach of the fourth rule.

The Arādhyās do not deny the authority of this text: but they monstrate that were they to obey it they should be excluded from braminical order. Accordingly they admit the rule, but agree to d obey every one of its demands.

The Aradhya is charged by the Jangam with gross inconsistence using the prayers to the sun, which consecrate the braminical thre and also the *panch-axari* spell which consecrates the lingam.

The Aradhyas cannot venture to take the last step by performi the rite called *shad-axari*, for that implies becoming a *Sannyāsi* recluse, shaving off the braminical lock, and assuming the tinted dre These would at once place them in the *Jangam* class: and few Ar hyas have the resolution thus to renounce the law of caste. Acco ingly the Jangams abhor them, and to use their own words "hold sin even to look upon an Aradhya." Thus we see there is bigo enough on both sides.

Miscellaneous Particulars.

In speaking of their literature the following distinctions are necessary.

They discriminate three paths or opinions: viz. the Carma-canda, the Jnána-canda, and the Bhacti-canda.

The Carma-canda, or Law of Works, attributes every good and evil act to ourselves. Accordingly men are to be rewarded or punished according as their lives are virtuous or the contrary.

The Jnana-canda, or Law of Wisdom, opposes this; stating that men are the mere instruments of good or evil in the hands of God.

The Bhacti-canda, or Law of Faith, calls upon men to adhere to virtue or benevolence as being the *fruits* of faith:—but adds that the deity is all in all, and our good deeds have nothing to do with salvation.

The *theory* of this creed may be traced to the MI'MA'NSA philosophy; which is thus defined in WILSON'S Sanscrit Lexicon. The first part, the *púrva Mímámsa*, or Mímamsa simply, illustrates the *Karma Kánda* of the Vedas; or the practical part (the ritual) of religion and devotion, including also moral and legal obligations. The second part, or *Uttara Mímámsa*, ascribed to Vyása, is the same as the Vedanta, founded on the Jnána-canda or theological portion of the Vedas, and treating of the spiritual worship of the Supreme Being or soul of the universe.

We must however observe that the Lila is often called "*Shanmatasammatam*," that is tolerant or universal, because free from the intolerance which we often meet in other treatises.

While compiling these notes it has been pointed out to me that few of the English are able to obtain the Vira Saiva treatises. This is true, and the manuscripts which we may succeed in obtaining, too often prove incomplete or erroneous. I shall therefore be willing to supply copies to any who may require these works: and the cost of transcription will be found moderate.*

Likewise copies of the VEDANTA RASAYANAM, a poem the beauty of which is greatly disparaged by the poet's earnest endeavours to prove that the Christian religion is very analogous to what he considers pure Braminism. He goes so far as to designate Christians *Dwija* and *Bhusura* which are mere poetical titles for Bramins as "gods on earth." He seems to think it an easy thing to reconcile two creeds which are as distinct as light and darkness.

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* The Lila contains 6900 dwipada lines, the Puran and the Charitra are each of them about twice that length.

The image is usually placed on the infant's neck on the eleventh day after birth. In the books are fables about their bestowing it much sooner.

For putting this sign on an infant they give this reason. They look upon the child as a heathen until this rite is performed: and it is unlawful to have under their roof a heathen who does not worship their god, and whose eye would contaminate their food.

A life of celibacy is held in small repute: but some, both men and women, embrace it. The rite of marriage among them costs very little indeed. In these points they more resemble the customs of Christians than those of Hindus or Musulmans.

They are as fond as are all Hindus of making vows: often empty and iniquitous enough: but if we may judge from the legends in their books, their vows are chiefly made with a view to obtaining future happiness by the means of charity shewn towards brothers in the creed. Though Aradhyas bestow initiation on women only at the time of marriage, these two rites have no connection, and it is of no consequence whether one or the other is first administered.

The Jangams state that in the present age they very rarely make proselytes: and the reason is that in latter days the teachers insist on ten or twelve years of probation, and this wearies out the zeal of the aspirant.

Looking upon themselves alone as being in the true faith, the Jangams consider the *purva-Saivas* (Smartas) to be in an imperfect state. To use the Jangam's own expression, *their* creed is the flower, ours is the fruit.

The Smartas never make the smallest mention of Basava: they honour *Nandikeswara* which the Jangams say is only another name for Basava.

The difference between *Samanyas* and *Visēsha* Jangams has been pointed out. But it is not easy to understand in what respects the confirmed class is superior. They acknowledge that both classes have an equally strong hope of future happiness.

All the sects who look upon Siva as their god *profess* to imitate his garb (that of a *sannyasi* or monk) by smearing ashes over their foreheads and bodies, so as to dress as penitents. A few Aradhyas attempt to wear this garb, which if worn as described in the Mari Basava Puran would be ridiculous enough. But in general the dress of Lingavants differs from that of other Hindus only in the rite of wearing the image.

The sect occasionally style themselves as *Mähēswars*, *bhactas*, *Ganas* or use the names of some other attendants on Siva. But these respectful titles are not conceded to them by others, and Bramins generally look upon them as *Pasandas* or hereticks.

The *Linga Baljas*, a class of Hindus who abound in the Cuddapah and Bellary districts are apparently the same tribe, who have been already described as *Cannadilu* or Visesha Jangams.

Notwithstanding their rejection of feasts and fasts, the Aradhyas are as strict as other Hindus in celebrating the Sivaratri feast. And the Jangams though they profess to condemn such superstition usually follow their example in this respect.

The *mantram* which I have described as breathed in the ear, is whispered in like manner in other sects:—of which a proof may be seen in the present Journal, vol. iii. p. 21.

The various *mudras* or attitudes used in prayer by Bramins, are observed by Aradhyas, as strictly as by Saivas. But the Jangam renounces them.

At the present day we rarely meet with Jangams of tolerable education even in their own language. Their religious prejudice have excluded them from most of those schools, wherein either Christians or Bramins are the masters: and I have heard of only one school at Madras, wherein a Jangam (under Christian directions) is the teacher. In many instances the Jangams are too poor to pay even the smallest stipend for education, however earnest they may be in a desire for instruction.

The Vīra Saivas resemble the old puritans in combining the devout and the warlike character. In their zeal against their religious foes the Jainas, they certainly were very intolerant. In modern days the insurrection at Kittoor and that at Mangalore have shewn how turbulent they can sometimes be. The king of Coorg, now a state prisoner, is a Jangam. The Raja of Punganoor near Chittoor is of the same creed.[*]

These Hindu barons are of the class already described as *Visesha Bhact*, which is free from any peculiarity in dress, and not having taken the higher vow, men of this class may not inconsistently be soldiers. The Mysore raja is often mentioned as being a *Sāmānya Bhact*, but it would appear that though attached to worshippers of Basava he is not himself a Lingadhari.

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[*] The reader is requested to correct a few errata in these pages. In p. 144, line 12, for *found* read *founded*. In p. 158 substitute the *Rucmangada Charitra* for the Bhanumad Vijayam where that name is accidentally repeated in line 24.

Conclusion.

The statements now made may be summed up in a few lines. The Jangams are a sect of Hindus who have lasted about seven hundred years. They adore Siva as the one God, and wear his image hung on their breasts. They call themselves primitive worshippers, and look upon others as idolaters. They say that they reverence the Vedas, the Bhagavad Gīta, and the doctrines of Sancar Achari, the great reformer of the Saiva creed who in point of time preceded their teacher Basava. But rejecting the Bhārata, the Bhāgavat, and the Rāmāyan they deny the authority of Bramins: by whom they therefore are detested as hereticks. They are the disciples of Basava, and as all Hindus are apt to exalt their teachers into gods, they declare Basava to be the god Siva himself. Basava though born a Bramin's son abolished every one of the braminical observances; particularly caste, pilgrimage, and penance. Some Bramins joined his creed, being in all probability his personal friends; he persuaded them to lay aside their name, and call themselves *Arādhyas*, or *Reverend* (καλοι, whence Caloyer the modern Greek name for a priest). But he could not induce them to lay aside the braminical thread: the rite of assuming which requires prayer addressed to the sun, as a god. Hence the Jangams assert that these, like other Bramins are idolaters: and accordingly the Arādhyas are rejected by them and treated with scorn.

They are a peaceable race of Hindu puritans: though at times they have been more warlike: and when their tenets became correctly known to the English there will appear no reason for excluding them from that patronage which has hitherto been extended only to Bramins, or those Hindus who reverence Bramins. Various prejudices have hitherto existed against the Jangams: these have now been investigated, and the result unreservedly communicated to the reader; who will find that the Jangam literature, however abhorred by Bramins furnishes an agreeable introduction to the various languages of Southern India.

Postscript.

The able reports printed in the Madras Journal have shewn the literary value of the Mackenzie manuscripts. But it is much to be regretted that a large collection now lying untouched in the India House is not transmitted to Madras, where the books might prove very useful. I allude to about *eighteen hundred* volumes of manuscripts, chiefly written on palm-leaves, in the Telugu, Canarese or Tamil character. Being in London in the year 1837, I obtained the permission of the then Librarian Sir Charles Wilkins, to examine and cataogue this collection. And I found therein 468 volumes in the Tamil haracter, 997 in the Canarese and 336 in the Telugu—not to menion about 250 which being in the Devanagari, Nandi-nagari, Bengali, r Orissa writing may be available to learned men at home. Were he manuscripts in the Telugu, Tamil and Canarese character transnitted to Madras, and placed under the care of the Literary Society t the College, they might afford us aid in many enquiries. Whereas n Leadenhall street they are buried in obscurity. I heard of these ooks only in the course of conversation when they were mentioned as eing written in nobody knew what language, and as forming part f the spoils of Seringapatam, or else as collected by the celebrated *eyden.*

The examination I made was very kindly brought to the notice of he Court, by Professor Wilson, who now succeeded to the Office of ibrarian. I was honoured with a letter of thanks, but would venture o suggest an application in the name of the Literary Society requestng that the Honourable Court would direct the transmission of these ooks to Madras; where, if no one else was inclined to undertake he task, I (if then present at Madras) would cheerfully engage to rrange them so as to be available for literary purposes, separating rom the mass those volumes which are of no value, and selecting those hich merit attention. I have lately ventured to apply to the learned ibrarian for the use of some manuscripts, which I at present require, but think that many will join me in expressing a regret that a collection so valuable should lie useless; surely the Honourable Court in transmitting these books to Madras, would retain the proprietary right while they rendered the collection available to the learned at large.

The rough draft of the catalogues, I prepared, is now left on the library table at the rooms of the Literary Society: and I think will suffice to shew the value of a collection which in its present state is lying entirely unavailable.

IX.—*On the Cultivation of Cotton in India.*—*By* J. M. Heath, *Esq.*

In the year 1818, the attention of the Madras Government was directed to the subject of the introduction of improved descriptions of agricultural produce into India. At that time I held the situation of Commercial Resident of Salem and Coimbatore, and instructions were sent to me by the Board of Trade, to attempt to introduce the cultivation of Bourbon cotton into those districts.

Being entirely unacquainted with the subject myself, I requested my friend Mr. J. M. Strachan, of the house of Arbuthnot and Co., to procure information for me upon the subject, from Mr. G. A. Hughes, of Tinnevelly, whom I knew to have been long engaged in the cultivation of Bourbon cotton.

In consequence of this application, I received the accompanying paper, drawn up by Mr. Hughes, and I have great pleasure in laying it before the Committee, as it appears to me to contain more information upon the cultivation of this valuable plant, than I have ever met with elsewhere.

In my endeavours to introduce the cultivation of Bourbon cotton into a part of the country where it had never before been tried, I had to encounter the usual difficulties which attend on the introduction of any novelty in agriculture: but these difficulties gave way to perseverance, and at the end of four years, I had the satisfaction to see the experiment completely successful. In the season 1823-4, I procured from the district of Coimbatore, 500 bales of clean Bourbon cotton, of 300 lbs. each, and the natives were by that time so well satisfied that the cultivation of this article was more profitable to them than that of the indigenous species, that, I believe, had encouragement to the cultivation been continued, it would, by this time, have completely superseded that species of indigenous cotton which is cultivated in the light and gravelly soil so abundant in the South of India.

In the Madras territories, two varieties of the cotton plant are cultivated, and they require very different soils: one is an annual plant, called in Tamul, *Oopum Parutti;* the other is a perennial plant called *Nadum Parutti:* the first comes to perfection only in the black adhesive soil, known by the name of cotton ground, and which appears to be formed from the decomposition of trap rocks: the other plant requires a very light loose soil, such as is formed from the disintegration of granitic rocks, and the soil appears more favourable for its growth when mixed with the calcareous tufa, known in India by the name of *Kankar.*

It was in soil of this kind, which occurs abundantly in Coimbatore, that my experiments were made: I made an abridgment of Mr. Hughes's paper, and had it translated into Tamul; a copy of this was given to each farmer who agreed to make trial of the seed, and I had a person whose duty it was to go round and inspect the progress of the cultivation, and to make monthly reports to me upon it; at the proper season for pruning the plants, I went myself and showed how the operation should be performed, and I believe that the success of the experiment was, in a great measure, owing to this step. I have never observed that the process of pruning has been adopted by the natives in any branch of their husbandry; and I believe it is quite indispensable for the successful cultivation of the Bourbon cotton.

In the districts on the Coromandel coast, south of Madras, the light soil above described is more abundant than any other; and there is no doubt that the Bourbon cotton plant might be successfully cultivated wherever it occurs: the only point on which my experience differs from that of Mr. Hughes is, as to the influence of vicinity to the sea, upon the cultivation of this plant. He seems to think that situations near the sea are necessary to bring the plant to perfection; my experience goes to show that it will come to perfection at 150 miles from the sea.

At the time I commenced my experiments, the price of cotton (Oupum), was about 3*d.* per pound in the district; this was a high price comparatively, and had been caused by the unprecedented demand for cotton in 1818: the usual prices had ranged from 2*d.* to 2¼*d.* To induce the farmers to make trial of the Bourbon seed, I offered them a price for their uncleaned cotton, which would have made the cost of clean cotton about 4½*d.* per pound; the value of the Bourbon cotton in the English market was fully 50 per cent. more than that of the country cotton; and in some instances where proper attention was given to the cleaning, the value of the Bourbon was more than double that of the country cotton.

Before I quitted India, in the year 1825, the situation of Commercial Resident of Salem and Coimbatore was abolished, and the Company discontinued their encouragement of the cultivation of Bourbon cotton in that quarter. The natives not requiring so fine a material for their own use, and not finding a market for it, on the part of European merchants, discontinued the cultivation: and a great proportion of the land which I left under cultivation with Bourbon cotton, was cleared to make room for grain, or some produce which was more certain of a ready mark The subject was subsequently taken up by a gentleman who had charge of my private concerns in India during my absence in Engla and the provision of Bourbon cotton is, I believe, still continued by hi although I have no means at present of saying to what extent.

Paper by G. A. Hughes, Esq., *enclosed in the preceding.*

The plant is of so hardy a description that it may be safely believe it will grow well in any situation, yet to have it sufficiently productiv much attention must be given to soil as well as to culture. With th view, all very rich, heavy, retentive stiff soils, should never be selected for although they produce luxuriant plants, yet they have much an more tendency to produce redundancy of wood and leaf than of produc and almost always to the generating of insects. The red and brow loams, or, indeed, any silicious or calcareous soil, fertile in a modera degree, are, upon the whole, in my idea, the most suitable and the mc fruitful. What is commonly known to us under the denomination cotton soil, the deep black vegetable loam, is, I think, to be entir avoided. The Bourbon species has almost in all respects, a charac different from the indigenous, and as far as my observation goes, mands a mode of treatment similar to that of America. In the po of climate, the vicinity of the sea, or situations to which the influen of the sea air extends, are, on every account, I believe, to be preferr The vicinity of the Ghauts, or any situation near high mountains, on o Peninsula, should not possibly be chosen, because the climate ne them is certainly likely to be less uniform in the hot months than th shrub requires; a dry soil and a dry atmosphere from March to Ma and from July to September, seem almost essential to the good qualit of the wool as well as to its productiveness.

Before touching upon the operation of pruning, which I practi twice in the year, and not once only, it might be as well to say som thing on the culture. I am now entirely convinced the plant wi last a great number of years, and will not at all fall off if well and pr perly managed. The objection to this in other countries is said to that it produces swarms of insects, but this, I suspect, is the defect treatment and of soil, rather than the age of the plant, since th youngest plantations are equally liable to this evil. Under the pe suasion that it may be preserved with advantage many years, a sy tematic and careful culture from the very first must be the best. Th seeds should be sown, or the young plants be set in straight row eight feet apart, and the rows also regularly eight feet asunder. Pla ing the little mounds of plants (containing two, or at most three each), at regular squares, in this mode, is of much advantage throughout. The facility for ploughing and heeing is greater in this than in the common methods. The free admission of sun, the freest circulation of air and light winds, are of the greatest benefit to a perfect culture. This may be mentioned, because I know that too close a cultivation is a common mistake. By the last mode, the plantation may become a close low thicket so much infested by rats and snakes, as almost to be a work of danger to enter it. If the seed can luckily be got into the ground in September, the young plant may be sufficiently strong to resist the pernicious and continued wet of a heavy monsoon. Little is gained by sowing seed in October, November, and December, unless the land is very high, of a dry description, and clean from weeds, which, at this period, generally smother all other vegetation near them. The clear intervals of these months answer well of course for transplanting, and the first week of January, in general, very well also, both for sowing and transplanting. It is well, however, to have the plants well established in the soil some days before the heavy rains, and with this object, I have lately succeeded wherever it was desirable, in transplanting the young plants on the very first rain, and this year early in October. They bear it extremely well in cloudy and light rainy days, and it will succeed without doubt, immediately, if they have a small portion of earth attached to them. Whenever this mode is proposed, a seed bed must be prepared and sown in July, in soil tolerably good, and watered from some well near the place that is to receive the plants in October.

Of late I have given the plantations under my own immediate eye their principal pruning, as soon as ever the heavy rains have passed away, say from the 15th to the 31st December, or just at the time before the sap becomes active. In the fine days of January, I plough the plantation thoroughly three or four times over. In less than two months the whole is again in the finest foliage and in full blossom, and continues in full bearing all the months of March, April, and May. Just at this time, at the crisis of extreme heats, a short suspension may be observed to the production of fruit-buds. I should mention that, at the pruning above adverted to, I clear the plants entirely of all the very young wood, or all with soft green bark, cutting the shrub down generally to two feet high and two feet wide, but leaving all that can be properly left of the firm wood with the strong white and brown bark. In June again there will generally be a good portion of pods still remaining on the plant, and the rain here is at that season very light; and

I find it enough to cut away merely the long straggling twisted soft shoots with diminutive pods; and if this is done very early in June, the better. But under all circumstances, the plant would yield a good produce from July to September, unless it should receive any damage from rain in those months. In June, perhaps, if the soil allows, it is enough to give the plantations a slight hoeing with the mamootis. In the old plantations, nothing seems necessary to be attended to in the monsoon, but draining them of the rain as much as may be practicable.

I know not well how to answer the query regarding the annual produce on any given quantity of land—at least with the precision and satisfaction I would wish to do. It is a very speculative point, and admits of wide limits of estimation. We may learn from books, that from 200 to 300 pounds of clean cotton are produced, and are expected, per acre in the West Indies and in America. Here some of my dependants, to whom I have alloted small spots of land to grow it for me in their way, think they perform wonders if they give me as much as fifty the acre. This is obviously a matter mostly resolving itself into the degree of judgment or diligence exercised in the cultivation, and no less so perhaps in the suitableness of soil and situation. Speaking for myself, I shall be very well content indeed to be sure of getting one hundred pounds the acre of fine clean cotton; and yet, adverting to the very prolific nature of this species of cotton shrub, I can give no good reason why much more might not be expected. On this point, important as it must be admitted to be, and on all considerations of expense, as compared to the produce from any given measurement of land, I must confess that with all my experience I yet feel an incompetency to impart anything like precise and definite information. I cannot calculate my cotton to cost me less in this country than twelve-pence the pound. The freight is of course paid in England. But it is very obvious that if it were within the possible labours of any individual to produce anything in quantity that was material, the benefit would be abundantly handsome; but the difficulties to carrying it on on a large scale, cannot be known to those who have not engaged actively in the undertaking. The natives can in nothing be trusted, as I have found to my serious loss. But I will pass from these considerations to what is of much more importance.

The extract of a letter I lately received from my London agents, which I annex, may prove of great utility in pressing upon the tention of your friend, the vast importance which is attached t process of cleaning. I have known, to my cost, how easily these t may be overlooked: care to this department of the business commence from the very gathering of the pods. The cotton should never be picked but at the most mature state; and even then, although gathered in the very hottest weather, the seed contains so much moisture that it is well to have it carefully dried immediately afterwards, two or three days, and before it is set aside; and care too should be taken that it does not at this time contract dirt and sand in the wool. Before I send it to the mill, it is now my practice to have the pods of cotton, as it is attached to the seed, most carefully examined in the first instance, and all the decayed, damaged, discoloured, immature part of it, first separated; at this stage, probably, not less than one-tenth of the whole is rejected in this way—and it is well rejected; it is then put to the mill after a little exposure to the sun in the usual way everywhere. But at the same time that the wool is separated from the seed, I have other women always present to clean it again by hand, as soon as it comes from the mill; all remaining impurities are better detected at this time than if the wool were previously pressed together again. The wool in this way is merely, I may say, *searched*, not pulled or broken. Even in this process there is a loss of scarcely less than five per cent. It is a good day's work for one woman to clean by the mill 9¾ pounds of paruttis, or the cotton with the seeds; the wool which is separated is quite as much as another will manage, giving a produce of 2¼ pounds on a large average of very fine and extremely clean cotton, which is immediately placed in strong Dungaree bags, until I have enough for a bale.

Extract of a Letter from Messrs. Fairlie, Bonham, and Co., London, 22d April, 1817, *to George Arthur Hughes, of Tennevelle.*

"We enclose the Price-Current of cotton-wool at the present sale at the India House, amongst which it gives us much pleasure to point out your five bales by the *Grant*, which sold from 2*s*. 1⅝*d*. to 2*s*. 1⅞*d*. per pound.

"The great improvement which this parcel shows to be attainable in the cultivation of the Bourbon species with you, is indeed very encouraging, and seems to open a fair field to future operations on a more extended scale; you have hitherto succeeded in this instance only, in producing a real equivalent for the Bourbon wool, what we formerly had, being but a distant imitation, and in request only when the true Bourbon was particularly scarce and dear. For it is not the fineness, nor the cleanness of the staple, important as these qualities must always be, that will suffice to raise it to its proper estimation. Evenness of fibre, and susceptibility of being drawn out into a thread, without the fibre being entangled, are also indispensable, and may be greatly marred by the process of beating with sticks, so as to occasion that entanglement. Managed as the present consignment has been, so much superior to the preceding fifteen bales, any quantity would here meet a ready sale, and we should suppose would amply recompence the trouble and care which it demands.

"We think this is a matter of so much importance, that we have taken a sample from these bags, which we intend to accompany this letter, that, by reference to it, you may keep in view the qualities that would always command this market."—*Journal of the Royal Asiatic Society*, vol. 5, p. 372-8.

ART. X.—*On Indian Iron and Steel; in a Letter addressed to the Secretary to the Royal Asiatic Society of Great Britain and Ireland.*

—*By* J. M. HEATH, ESQ.

IN the month of Jnne, 1837, the Managing Directors of the Indian Iron and Steel Company received a letter from Robert Clerk, Esq., Secretary to the Madras Governor, forwarding a copy of your letter of the 17th of February, 1837, addressed to the Governor of Madras, requesting information on the subject of wootz*, or Indian steel: the purpose of Mr. Clerk's letter was to ask us to furnish the information and specimens required by you, provided we could do so without inconvenience or detriment to our own interests.

At the time Mr. Clerk's letter was received, I was the only [illegible] of the Managing Directors who was in possession of sufficiently [illegible]tailed information on the subject of the manufacture of Indian st[illegible] to be able to reply to the queries contained in your letter, but as [illegible] duties I had to discharge at that time in the superintendence of [illegible] iron works at Porto Novo, were exceedingly laborious, it was a[illegible]gether out of my power to turn my attention to the subject pr[illegible]ously to my departure from India, in November, 1837: the lei[illegible] afforded by the voyage home has enabled me to resume the subjec[illegible] your letter, and I have now the pleasure to communicate to you such information on the subject of Indian steel, as my experience has enabled me to collect.

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* Wootz, or Oots, is probably the name of steel in the Guzerattee language in [illegible] Bombay, from which place the first specimens of Indian steel were sent to England [illegible] that name.

The ore from which the wootz steel is made, is the magnetic oxide of iron, combined with quartz, of which specimens accompany this letter: the ore varies much in its appearance, according as the grains of quartz and oxide of iron are large or small, but the proportion in which the component parts unite, is nearly uniformly 48 of quartz and 52 of oxide of iron, in 100 parts by weight.

It is found in many parts of the South of India, but the district of Salem is the principal seat of the steel manufacture. The ore occurs generally in the form of low hills, and the quantity of it which is exposed above the surface of the surrounding country, is so considerable, that it is not probable that it will ever become necessary to have recourse to under-ground operations, supposing the smelting of iron ore from this district to be carried on to any extent that can be contemplated.

It is prepared for being smelted by stamping and separating the quartz from it, either by washing it in a current of water, or by winnowing it in the manner in which rice is separated from the husk: in most of the deposits of ore, parts are found in which the quartz is in a state of disintegration, and these, from the greater facility with which they are broken, are always selected by the natives for their furnaces.

The furnace, or bloomery, in which the ore is smelted, is from three to five feet high from the surface of the ground, and the ground is hollowed out beneath it to the depth of from eight inches to a foot: it is somewhat pear-shaped, being about two feet in diameter at the ground, tapering to about one foot diameter at the top: it is built entirely of clay, two men can finish one in a few hours, and it is ready for use next day. The blast is supplied by two bellows, each made of a single goat's skin, with a bamboo nozzle: the two nozzles meet in a clay pipe, which passes about half-way through the furnace at the level of the ground, and by working the bellows alternately, a tolerably uniform blast is kept up; a semicircular opening, about a foot high and a foot in diameter at the bottom, is left in the furnace, and before each smelting, it is built up with clay. The furnace is then filled up with charcoal, and a lighted coal being introduced before the bellows, the fuel in the interior is soon kindled: as soon as this is accomplished, a small portion of the ore previously moistened with water, to prevent it from running through the charcoal, but without any description of flux, is laid on the top of the fuel, and charcoal is thrown over it to fill up the furnace: in this manner ore and fuel are added, and the bellows plied for four hours or thereabouts, when the process is stopped; an the temporary wall in front of the furnace having been broken dow the bloom is removed by a pair of tongs from the bottom of the furnac it is then beaten with a wooden mallet to separate as much of the vitrified oxide of iron as possible, and while still red hot, it is cut throug the middle with a hatchet, in order to shew the quality of the interi of the mass: in this state it is sold to the blacksmiths, who perform a the subsequent operations of forging it into bars and making it in steel.

The process of forging the iron into bars is performed by sinkin the blooms in a small charcoal furnace, and by repeated heatings an hammerings, to free it as much as possible from the vitrified an unreduced oxide of iron: it is thus formed into small bars about a fo long, an inch and half broad, and about half an inch thick; in th state the iron is full of cracks and exceedingly red short; and were a English manufacturer of steel to be told that cast-steel of excelle quality could be made from such iron, he would treat the assertion wi great contempt.

It is from this unpromising material, however, that the India steel is always made; the bars of iron just described, are cut in small pieces to enable them to pack close in the crucible: a quanti of these pieces amounting to about half a pound, and from that to tw pounds, as the mass of steel is required to be of greater or less weig is then put into a crucible alone, with a tenth part by weight of dri wood chopped small, and the iron and wood are then covered over wi one or two green leaves; the mouth of the crucible is then filled by a handful of tempered clay, which is rammed in so close as to exclude the air perfectly.

The wood which is always selected to furnish carbon to the iron, i the *Cassia auriculata*, and the leaf used to cover the iron and wood i that of the *Asclepias gigantea*, or, where that is not to be had, that o the *Convolvulus laurifolius*. As soon as the clay, used to stop th mouths of the crucibles, is dry, they are built up in the form of an arc with their bottoms inwards, in a small furnace urged by two goat-ski bellows; charcoal is heaped up over them, and the blast kept up wit out intermission for about two hours and a half, when it is stopped, a the process is considered complete: the furnace contains from twen to twenty-four crucibles.

The crucibles are next removed from the furnace, and allowed cool; they are then broken, and the steel which has been left to sol dify is taken out in a cake, having the form of the bottom of the crucible; each cake is the produce of one crucible, and the steel is new procured from a larger quantity. When the fusion has been perfect, the top of the cake is covered with striæ, radiating from the centre, but without any holes or rough projections on it; when the fusion has been less perfect, the surface of the cake has a honey-combed appearance, caused probably by particles of scoriæ and unreduced oxide in the bar-iron, and often contains projecting lumps of iron still in the malleable state.

The crucibles are formed of a red loam, which is very refractory, mixed with a large quantity of charred husk of rice; they are made by taking a lump of the tempered clay in one hand, and giving it a rotatory motion, while it is hollowed out by the fingers of the other hand: each crucible serves only for one operation.

The natives prepare the cakes of steel for being drawn into bars by annealing them for several hours in a charcoal fire, actuated by bellows, the current of air from which is made to play upon the cakes while turned over before it at a heat just short of that sufficient to melt them. It appears from this, that in order to insure the fusion of the contents of the crucible, it is found necessary to employ a larger dose of carbon than is required to form the hardest steel, and that this excess is afterwards got rid of by annealing the cakes before a current of air at a high heat, the oxygen of the air combining with and carrying off the excess of carbon in the gaseous form: without this operation none of the cakes would stand drawing into bars without breaking.

The only fuel employed by the natives of India throughout the different stages of iron and steel making is wood charcoal. The magnetic oxide of iron, when separated from the quartz with which it is naturally combined in the ore from which the wootz steel is made, consists of 72 per cent. of iron and 28 of oxygen. The native method of smelting the ore is so exceedingly imperfect, that the produce from their furnaces in bar-iron does not average more than fifteen per cent.

When specimens of Indian steel were first examined by chemists in England, they were quite unable to discover the process by which it had been manufactured. The late Dr. Pearson published an account of his examination of this substance in the seventeenth volume of the *Philosophical Transactions*, and the result of his observations is in these words: "We may without risk conclude that it is made directly from the ore, and consequently that it has never been in the state of wrought-iron." Dr. Buchanan's *Travels in the South of India* were published in the year 1807: they contain a very minute and correct account of the native processes of smelting iron and making it into steel, illustrated by engravings. Dr. Heyne's *Tracts on India*, were published in 1814, and they also contain an account of both processes, along with a very interesting letter from the late Mr. Stoddart upon the quality of Indian steel, which he pronounces to be decidedly superior to any other description of steel; yet in page 223, of the first volume of the *Treatise on Metals*, lately published, it is stated, « that the wootz of India, in the state in which we receive it, is the immediate product of the ore, seems to be undoubted."

The principle of the Indian process is so different from that practised in England for making cast-steel, that it is not surprising that in the absence of all information upon the subject, Dr. Pearson should have formed an erroneous opinion as to its nature. It has always appeared to me one of the most astonishing facts in the history of the arts, that the Hindus should be in possession of a process, the theory of which is extremely recondite, and in the discovery of which, there seems so so little room for the agency of chance: it is impossible to suppose, however, that the process was discovered by any scientific induction, fo or the theory of it can only be explained by the lights of modern chemi try: in fact, all speculation upon the origin of the discovery seems us less. It appears an easy matter to trace the successive steps of th steel manufacture in Europe. In Europe, steel seems first to have bee made in modern times in Germany; the process consisted in partial decarbonating cast-iron in a finery, and bringing the metal under t hammer before the process for converting it into malleable iron w completed: this was, of course, the work of chance, as was also the fu ther discovery that the iron manufactured from some kinds of iron o was fitter for making this natural steel, as it is called, than that m from other ore: this was for a long time the only description of st made in Europe, and although the manufacture of cutlery has b established in England for some centuries, yet the only steel used f this purpose, for a very long period, was the natural steel of Germany. As soon as chemical investigation had discovered that steel consi ed of pure iron united to a very small proportion of carbon, an obvio experiment would be to endeavour to form steal by synthesis; a hence the process of subjecting pure malleable iron to a high hea contact with carbon, producing blistered steel as the result. This in the manufacture was found to be a great improvement upon the man steel, and the next step which would immediately suggest i that of welding several bars of blistered steel together, and dr them down into a single bar under a very heavy hammer, formin is called shear-steel, was found still further to improve the q still it was found that all these descriptions of steel possessed which rendered them unfit for purposes which required a hig and a fine and strong edge: these defects could evidently to impurities in the body of the steel, or variations in its quality; and it would seem an obvious suggestion to endeavour to equalize the quality of the steel by reducing it to the fluid state in a close vessel, so as to prevent the dissipation of its carbon by exposure to the air at a high temperature. This is, in fact, the process now followed in England for making cast-steel, which is the only description of steel fit for fine cutlery: and simple and inartificial as the process appears, it was only discovered in England about the middle of the last century.

The antiquity of the Indian process is no less astonishing than its ingenuity. We can hardly doubt that the tools with which the Egyptians covered their obelisks and temples of porphyry and syenite with hieroglyphics were made of Indian steel. There is no evidence to shew that any of the nations of antiquity besides the Hindús were acquainted with the art of making steel. The notices which occur in the Greek and Latin writers on this subject serve only to betray their ignorance of it: they were acquainted with the qualities and familiar with the use of steel, but they appear to have been altogether ignorant of the mode in which it was prepared from iron. The arms and cutting instruments of the ancients were all formed of alloys of copper and tin, and we are certain that tools of such an alloy could not have been employed in sculpturing porphyry and syenite.

Had the ancient nations of the west been in possession of the process of converting iron into steel, there can be no doubt that they would have used it in the fabrication of their arms, for in all parts of the world where steel is made, it can be sold much cheaper than copper. The price of steel in India is about one-fifth of the price of copper, but the expense of transporting it from India to Europe and Egypt by the ancient routes of commerce would have enhanced its price so much as to restrict the use of it to such articles as required to be possessed of a degree of hardness which could not be imparted to any other metal. One certain fact has reached us regarding the antiquity of the steel manufacture in India: Quintus Curtius mentions that a present of steel was made to Alexander of Macedon, by Porus, an Indian chief, whose country he had invaded. We can hardly believe that a matter of about thirty pounds weight of steel would have been considered a present worthy the acceptance of the conqueror of the world, had the manufacture of that substance been practised by any of the nations of the west in the days of Alexander. We may judge from the extent of the present, how much the cost of the article had been enhanced by transport from the place of its manufacture to the country of Porus.

We know that a maritime intercourse was maintained from the remotest antiquity between the Malabar coast, the Persian Gulf, the country about the mouths of the Indus and the Red Sea; and it appears reasonable to conclude that the steel of the South of India found its way by these routes to the country of Porus, to the nations of Europe, and to Egypt.

It appears then that the claim of India to a discovery which has exercised more influence on the arts conducive to civilization and manufacturing industry, than any other within the whole range of human inventions, is altogether unquestionable. What a theme for a reflective mind is the consideration of what would have been the social condition of the human race had the art of converting iron into steel still remained undiscovered.

A few remarks seem called for, regarding the distinguishing peculiarity of the Indian process of steel-making.

It will have been observed that it differs from the ordinary English process, from the circumstance of the iron being put into the crucible in the pure state, and without having gone through the process of cementation or conversion into blistered steel.

That iron could be converted into cast-steel by fusing it in a close vessel in contact with carbon, was a discovery made by Mr. D. Mushet about the year 1800. This was undoubtedly the original idea of a man of talent, following the light thrown on the theory of steel-making by the discoveries of modern chemistry. The substances Mr. Mushet proposed to use, were " charcoal-dust, pitcoal-dust, plumbago, or any substance containing the coaly or carbonaceous principle." Now this specification unquestionably comprises the principle of the Indian process, which adopts the use of dry wood, which is a "substance containing the coaly or carbonaceous principle." I believe, however, that Mr. Mushet*, in practice, confined himself to the use of charcoal-powder in preference to dry wood, in consequence of the comparatively small bulk of the former required to carbonate the iron, and the consequent saving of space in the crucible.

In the year 1825, Mr. Charles Mackintosh† took out a patent for converting iron into steel by exposing it to the action of carburetted-hydrogen gas in a close vessel, at a very high temperature, by which means the process of conversion is completed in a few hours, while by the old method it was the work of from fourteen to twenty days.

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* Mr. Mushet took out a patent for this process, but, owing to causes entirely unconnected with the merits of the discovery, it was never successfully carried into practice.

† The patentee of the Indian-rubber waterproof fabrics. Mr. Mackintosh also took out a patent for his process for steel-making; but although I have seen samples of the steel made in this way, yet the process was not found to answer on a large scale: it was found impossible to keep the chambers in which the bars of iron were suspended air-tight at the very high temperature to which it was necessary to raise them in order to enable the iron to combine with the gaseous carbon.

Now it appears to me that the Indian process combines the principles of both the above described methods: on elevating the temperature of the crucible containing pure iron and dry wood and green leaves, an abundant evolution of carburetted-hydrogen gas would take place from the vegetable matter, and as its escape would be prevented by the luting at the mouth of the crucible, it would be retained in contact with the iron, which, at a high temperature, appears from Mr. Mackintosh's process to have a much greater affinity for gaseous than for concrete carbon; this would greatly shorten the operation, and probably at a much lower temperature than were the iron in contact with charcoal powder. In no other way can I account for the fact that iron is converted into cast-steel by the natives of India in two hours and a half, with an application of heat, that, in this country, would be considered quite inadequate to produce such an effect, while at Sheffield it requires at least four hours to melt blistered steel in wind furnaces of the best construction, although the crucibles, in which the steel is melted, are at a white heat when the metal is put into them, and in the Indian process, the crucibles are put into the furnace quite cold.

I do not believe that the Indian process exercises any influence upon the quality of the steel; its only advantage appears to be that it enables the Hindú to accomplish an object with the very imperfect means of applying heat within his reach, which it would be altogether hopeless for him to attempt, were he to imitate the steps of the European process.

It seems probable that the selection of particular kinds of vegetable matter to afford carbon to the iron, may not be altogether a matter of fancy. The Indian steel-maker of course knows nothing of the theory of his operations: he is satisfied with knowing that he can convert iron into steel by fusing it with what he calls "medicine," and this medicine experience has taught him must be dried wood and green leaves; and as different woods and leaves very probably contain carburetted-hydrogen in very different proportions, experience may have taught the Hindoo that he can make iron pass into the state of steel more quickly and with a smaller bulk of particular kinds of vegetable matter, than with others. The *Cassia auriculata* is the only wood I have ever seen used for the purpose; it contains a large quantity of the extract called catechu: the leaf of the *asclepias* contains an acrid milky juice: the leaf of the *convolvulus* is in no respect remarkable.—*Journal of the Royal Asiatic Society*, vol. 5, p. 390-7.

XI.—*Proceedings of the Madras Literary Society and Auxiliary the Royal Asiatic Society.*

13*th January* 1840.—*The Annual General Meeting of the Society:— The Hon. Sir* Robert Comyn, *President, in the Chair.*

The Secretary submitted to the Meeting, their statements of the Society's account for the past year.

Abstract Statement of the Funds of the Madras Literary Society and Auxiliary of the Royal Asiatic Society, from the 1st January, to the 31st December 1839.

	Disbursements			Receipts.	
Balance in favour of the Society as exhibited in the statement submitted to the annual General Meeting, held on the 30th January 1839.	....	..	..	482	11
Total Amount of subscriptions received from the 1st January to the 31st December 1839	....	..	..	4270	5
Difference of interest in favour of the Society as stated in Messrs. Binny and Co's account closed on the 31st December 1839........	....	..	..	13	12
Messrs. Binny and Co's.commission on amount of receipts.......	42	11	3		
Remitted to Messrs. Wm. H Allen and Co. booksellers..............................	2042	8	10		
Pay of the Establishment.......	1599	4	0		
Postage....................................	78	10	0		
Stationery................................	35	1	0		
Cooly hire................................	2	0	6		
Sundries	41	0	0		
Expenses incurred in binding books.......	18	0	3		
Subscriptions for the Bombay Courier and Army List..............................	68	0	0		
Subscriptions for the Bengal Herald and Army List.	34	0	0		
Books purchased at Madras	64	8	0		
Paid for printing advertisements, &c......	9	1	0		
Paid for printing the Catalogue of the books in the Library	92	12	0		
Paid for paper to print the Catalogue........	42	0	0		
	4169	8	10	4766	13
Deduct disbursements..........................				4169	8
Balance in favour of the Society..................				597	5

Abstract Statement of the Funds of the Asiatic Department.

	Disbursements			Receipts		
Balance in favour of the Society as exhibited in the statement, submitted to the annual General Meeting, held on the 30th January 1839	....	..	..	1107	7	0
Total amount of subscriptions received from the 1st January to the 31st December 1839..	....	..	..	1056	10	8
Amount realized by the sale of the Madras Journal of Literature and Science........	....	..	..	1243*	0	0
Difference of interest in favour of the Society as stated in Messrs. Binny and Co's. account current closed on the 31st December 1839..	....	..	..	4	9	5
Messrs. Binny and Co's. commission on amount of receipts........	22	15	11			
Remitted to Messrs. W. H. Allen and Co. for printing paper........................	1043	7	7			
Paid for printing the 22d, 23d and 24th Nos. of the Madras Journal of Literature and Science..................................	1002	15	0			
Pay of the Establishment	798	0	0			
Sundries.................................	42	0	0			
Paid freight, &c. on four boxes of books to London..................................	41	2	7			
	2950	9	1	3411	11	1
Deduct disbursements..................				2950	9	1
Balance in favour of the Society..................				461	2	0

The following donations having been made to the Society since the last Annual General Meeting, the thanks of the Society were unanimously voted to the donors:—

Trevandrum Almanac for 1839.......	J. Caldecott, Esq.
Jervis's Address on the various Surveys and other Scientific enquiries instituted by the Honourable East India Company throughout Asia..................	Major T. B. Jervis.
Martin's Eastern India 3 vols.........................	Madras Government.
Lord Brougham's Speeches 4 vols....................	Hon. Sir R. Comyn.
The Rev. Mr. Taylor's Examination and Analysis of Col. Mackenzie's Manuscripts 10 copies.........	Madras Government.
Notice Historique et Littéraire sur M. Le Baron Silvestre De Sacy............................... ..	Mons. Reinaud.
Evidences taken before the Houses of Parliament at the last renewal of the Charter..................	J. C. Morris, Esq.
The Rev. Mr. Taylor's two first Reports on the Mackenzie Manuscripts, reprinted at Calcutta........	Rev. W. Taylor.

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* Amount since realised and remitted to Messrs. Binny and Co. from the sale of the Journal Rupees 117

Rask's Samlede Afhandlinger 3d vol.	Royal Society of Antiquities.
Mémoire Sur la Découverte de l'Amérique au dixième Siècle	do.
A Map of Vinland	do.
General Chart exhibiting the discoveries of the Northmen in the Arctic Regions and America.	do.
Island á of anverdri tuindu öld eptir krists burd okum aldamótin ar 1000	do.
Julianeshaabs district Sandsynligviis indbefattende Oslerbygden	do.
Miller on Law	Hon. Sir R. Com
Oriental books and manuscripts	Lieut. Newbold.
List of Minerals collected from various parts of the Nizam's territories, the Ceded Districts, Kurnool, the Southern Mahratta Country, Mysore, &c.	do.
Rev. Mr. Spring's Malayalum Grammar	Rev. F. Spring.
Vertebra of a Whale, picked up on the shore at Pulicat.	do.

It was announced to the Meeting that the following gentleme been elected members of the Society since the last Annual G Meeting :—

Thomas Clarke, Esq
W. H. Bayley, Esq.
A. Mellor, Esq.
A. P. Forbes, Esq.
Major Moberly,
Captain W. Orr,
Z. Macaulay, Esq.

During the past year the Society has lost 16 members by dea tirement, or departure for Europe.

Read the following letter:—

ROYAL GEOGRAPHICAL SOCIETY.

LONDON, 1st August

SIR,

I have the honor to acquaint you that in accordance with th gestion of Major T. B. Jervis, Surveyor General of India, the C of this Society has resolved to present a complete set of its Jour the public library of each of the ten principal stations in Indi I have now the pleasure to forward a copy consisting of nine vol for the Library of the Literary Society at Madras, which I am quest you will be pleased to present in the name of the Geogra Society of London.

In making this communication the Council beg to express their that this Journal may prove useful to officers who may be abo undertake journeys in the various parts of India and in the adjacent countries; and also to make known to them that there exists a Society in London specially devoted to the advancement of geography, which will gladly receive, and publish in the best form, the correct account of any journey through a country of which our geographical information may be imperfect, as is the case throughout almost the whole of the vast continent of Asia.

We shall be thankful also for any new maps or works containing topographical details respecting the hitherto undescribed parts of the country adjoining Madras, which may be published in India.

I am desired to express the best thanks of this Society for the donation of the excellent Journal of the 'Madras Literary and Scientific Society' which you have had the kindness to forward to us, and to state that in future we shall gladly exchange our volumes against those published by your Society.

To the Secretary of the
Madras Literary Society, &c.

I am Sir,
Your obedient servant.
JOHN WASHINGTON,
Secretary.

P. S.—The nine other stations are Calcutta, Bombay, Hydrabad, Bangalore, Dum-dum, M'how, Delhi, Meerut and Cawnpoor; which I mention in order that officers moving from one station to another, and desirous of consulting the London Geographical Journal, may know where to find it.

I also enclose two copies of a printed paper of Hints for collecting Geographical information—which I shall be obliged to you to allow to lie on your table and be made public.

Resolved.—That the thanks of this Society be communicated to the Geographical Society, with the expression of the willingness of this Society to accede to the request to exchange Journals.*

Read a letter from Lieutenant Newbold, dated 31st December 1839, forwarding for the acceptance of the Society, several oriental books and manuscripts, and the thanks of the Society were unanimously voted to him for his valuable donation.

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* The Madras Journal has been regularly forwarded for presentation to the Royal Geographical Society since 1836.—ED.

Read a letter from the same gentleman, dated the 31st De 1839, transmitting for presentation to the Society, a list of n collected from various parts of the Nizam's territories, the Ced tricts, Kurnool, the Southern Mahratta Country, Mysore, &c., questing that it may be published in the first No. of the Journ shall issue after the Meeting. Thanks were likewise voted to this donation.

Read a letter from the Rev. F. Spring, dated 13th January 18 fering for the acceptance of the Society, a copy of his Malayalum mar, which he published last year, and for the museum the vert a whale which was picked up on the shore at Pulicat. The tha the Meeting were unanimously voted to him for his donation.

The Meeting proceeded to elect three members for the Com of Management for the ensuing year, in succession to J. C. Morr C. T. Kaye Esq. and J. Ouchterlony Esq. who go out by rotation; A. D. Campbell Esq. and N. B. Acworth Esq were duly e and J. Ouchterlony Esq. re-elected.

The business of the Meeting being concluded, the thanks Meeting were unanimously voted to the Honourable the Presid his able conduct in the Chair.

J. MINCHIN, *Secretary.* ROBERT COMYN, *President.*

Thursday Evening, 13*th February* 1840.—*The Venerable Arch* HARPER *in the Chair.*

It was intimated that the immediate purpose of the present m was (in the words of the requisition), " with the view of estab regular periodical meetings; when members should be reque bring with them, as visitors, any friends who feel an interest proceedings of the Society."

This question having been put to the meeting, it was unani resolved that a meeting of the Society shall take place on tl Thursday of every month; and, after some discussion, it was det ed that 8 o'clock in the evening should be the hour for the comi ment of business.

The following works were presented :—

Journal of the Asiatic Society of Bengal for September and October 1839.—By the Asiatic Society.

Captain Low's Dissertation on Penang and Province Wellesley.—By Lieutenant T. J. Newbold.

A help in acquiring a knowledge of the English language (English and Canarese). By the same.

Journal of a Tour along the coast of Java and Bali, &c. do.

Aperçu Général sur le Territoire D'Arménie. do.

The Risalah of Shekh Alkhatub—(Arabic). do.

Tasikhi Ferishta. do.

The History of Seringapatam and Madras in Persian. do.

The translation of the Gospels into Malay.—By Mr. R. L. Bruyn, Batavia 1832. do.

The Poems of Amir Khusroo (in Persian). do.

The thanks of the Society were voted to the donors.

The following communications to the Society were laid before the meeting:—

A description of a new species of Coluber (Naia), by Walter Elliot Esq.

This paper was read and discussed by the meeting; the stuffed skin of the animal, and a large coloured drawing, were exhibited.

(Published in our present number.)

Notes, principally geological, on Southern India, by Lieut. Newbold, with illustrative specimens of rocks.

(Published in this number.)

Continuation of Mr. Jerdon's Ornithology of Southern India.

60 original drawings of birds, by native artists, coloured from nature under Mr. Jerdon's own direction, were laid on the table, and excited general admiration at their beauty as works of art, and their fidelity to nature. It was intimated that Mr. Jerdon was desirous of publishing a series in lithograph, in the style of those given in illustration of his Catalogue in this Journal.

An account of the direction taken, and effects produced, by a current of electric fluid, which struck the house at the top of Palaveram hill, the property of Colonel Monteith, who witnessed the event:—Communicated by T. J. Taylor, Esq. H. C. Astronomer (with a plan).

A brief sketch of the Life and Writings of Father **Beschi**, or **Viramamuni**:—Translated from the original Tamil, by A. **Muttusami Pillei**, manager of the College of Fort St. George, and Moonshee to the Tamil Translator to Government.

Some singular spheroidal mineral masses were laid before the meeting by Mr. Elliot and Lieut. Cotton, forwarded by Assistant Surgeon J. Sanderson. They were found 5 miles west of the village of Streepermadoor, in the district of Chingleput, at a depth of from 2 to 3 feet from the surface, in the gravel of the laterite formation. These spheroids were about the size of cocoa-nuts, to which they bore some general resemblance, so as to have conveyed the idea of their being actually fossils, when they were first removed from their matrix. They are hollow within, or contain some aluminous earth, and the shell is composed of a kind of sandstone grit, very hard and compact, consisting of a dark ferrugenous paste, embedding minute fragments of quartz.

Specimens of the supposed fossils from the Peam Gunga River in th Hyderabad country, mentioned at p. 477 of the 19th No. of this Journal were on the table, and excited much speculation as to their nature the result of which will be noticed at a future time.

Thursday Evening, 5th March 1840.—*The Hon. Sir* **Robert Com** *President, in the Chair.*

The following work, presented to the Society, was laid on t table :—

Journal of the Asiatic Society of Bengal for November 1839.— the Asiatic Society.

The thanks of the Society were voted for the same.

The following communications to the Society were laid before meeting:

Colonel **Monteith**'s continuation of his Translation of Count Mey dorff's Journey from Orenbourg to Bokhara.

Mr. C. P. **Brown**'s Essay on the Creed, Customs and Literature of t Jangams—(Read to the Meeting, and published in our present No.)

Thursday Evening, 2d April 1840.—DR. WYLIE, *in the Chair.*

The following books, presented to the Society, were laid on the table:—

Result of Observations at the Madras Observatory for 1838 and 1839. ——By the Madras Government.

Narrative of the Discoveries of Sir Charles Bell in the Nervous System—By Alexander Shaw, Esq.—Presented, on the part of the author, by James Shaw, Esq.

The following communication to the Society was presented:—

CAPTAIN J. CAMPBELL on a supposed new mineral, a Titanate of Magnesia.

Thursday Evening, 7th May 1840.—A. D. CAMPBELL, ESQ. *President of the Committee of Papers, in the Chair.*

The following work, presented to the Society, was laid on the table, and thanks voted for the same:—

Mr. Piddington's Pamphlet on the Law of storms as applying to the tempests of the Indian and Chinese seas.—By the Government of India.

The following communications to the Society were presented:—

Continuation of the Catalogue of the Birds of Southern India, by T. C. JERDON, ESQ.—Tribe *Scansores.*

Account of a carboniferous stratum at Baypoor, near Calicut, Malabar coast. By LIEUT. NEWBOLD (Read to the meeting).

Desiderata in Indian Geology. By the same.

Specimens of the silicified wood from Turivacary, with lateritic rock, which appears to be the matrix in which the fossil is found, were presented in the name of C. T. KAYE ESQ. of the Civil Service.

Specimens from the same locality were also presented, received from LIEUT. NEWBOLD; also specimens of the shell limestone deposit near Pondicherry, presented by the same gentleman.

NOTE to page 86.

We must be excused from entering into a disquisition on the mineralogical differences of rocks, which would lead to endless, and, we fear, fruitless controversy. It is not the practice of the Editors of this Journal to remark on the communications of those who address the Society; the facts narrated and the opinions maintained are considered to be exclusively on the responsibility of the authors, and as such are usually submitted, without comment, to the Press. The Editorial note appended to our last number was not intended to be in contravention of Captain Campbell's statements, but solely to vindicate the scientific character of a respected correspondent now no more. We still maintain that Dr. Benza describes no other rock specifically than the hornblende rock or greenstone found *in situ* at Seringapatam; on the authority of Buchanan, and deceived by the external resemblance between that rock and the material of the pillars, he states, in general terms, the identity of the two; but he did not examine the *internal structure* of the pillars, nor did he visit the quarry at Cudhully; if he had, we are quite sure he would not have pronounced either of them to be hornblende.

We must here mention, however, that we have been led into an error regarding Lieut. NEWBOLD'S specimen, by the circumstance of his stating the pillars at Seringapatam and the stone of the quarry at Cudhully to be a variety only of the steatite which he was describing a specimen of from another locality. The latter is undoubtedly what he termed it; and the former is evidently one of the numerous varieties of serpentine, a nearly allied rock to steatite; judging from Lieut. NEWBOLD'S specimen, and also from a fragment from the pillars themselves, politely sent down to Madras by Captain Campbell for our inspection.—EDITOR.

NOTE to page 40.

With reference to the colour of the Naga, Mr. Elliot subsequentl writes, "it should be dark yellowish-ash, I think, but really the hu puzzles me."—EDITOR.

XII.—*Horary Meteorological Observations made agreeably with the suggestions of Sir* John Herschel.

At the Madras Observatory.—By T. G. Taylor, Esq. *H. E. I. C Astronomer.*

Date.	Time.	Barometer.	Thermometer.	Wet bulb.	Direction of wind.	Strength of wind.	Remarks.
Dec. 21	6 A. M.	30,100	71,8	68,5	N	1	Flying clouds, gentle wind.
	7	30,110	72,0	68,5	N	1	Flying clouds, do. do.
	8	30.150	74,0	70,0	N W	1	Haze do. do.
	9	30,170	76,6	72,0	N	1	Do. do. do.
	10	30,174	79,0	73,8	N	2,3	Flying clouds, strong wind.
	11	30,168	79,8	76,1	N N E	2,3	Flying clouds, do. do.
	12	30,136	80,8	72,5	N E	2	Cloudy do. do.
	1 P. M.	30,100	79,7	72,4	N E	2	Do. do. do.
	2	30,086	79,5	72,5	E N E	2	Do. do. do.
	3	30.073	78,8	72,0	N E	3	Do. do. do.
	4	30,064	78,8	70,5	N N E	2,3	Thick haze do. do.
	5	30,072	77,8	70,3	N E	2,3	Do. do. do. do.
	6	30,084	76,4	69,5	N E	2	Haze, moderate wind.
	7	30,102	76,0	69,5	N E	2	Do. do. do.
	8	30,122	75,9	69,3	N E	1	Do. gentle wind.
	9	30,132	75,9	69,3	N E	1	Do. do. do.
	10	30,130	75,7	69,5	N E	1	Flying clouds do. do. dew.
	11	30,120	74,8	69,5	N E	1	Do. do. do. dew.
	12	30,112	72,4	69,0	N	1	Do. do. do. dew.
	1 A. M.	30,081	72,3	68,9	N	1	Do. do. do. dew.
	2	30,058	72,2	68,5	N W	1	Do. do. do. dew.
	3	30,034	72,0	68,4	N W	1	Do. do. do. dew.
	4	30,044	71,6	68,2	N W	1	Clear do. do. dew.
	5	30,038	71,4	68,5	N W	1	Clear do. do. dew.
22	6	30,062	70,3	68,5	N W	1	Flying clouds do. dew.
	7	30,082	70,8	69,3	N W	1	Do. moderate wind.
	8	30,106	72,9	70,7	N	1	Do. gentle wind.
	9	30,124	76,2	72,5	N	1	Clear do. do.
	10	30,132	78,7	72,7	N	1,2	Flying clouds, strong wind.
	11	30,122	79,8	72,0	N E	1,2	Do. moderate wind.
	12	30,092	79,6	71,5	E by N	1,2	Do. do. do.
	1 P. M.	30,065	80,3	71,3	N E	1,2	Do. do. do.
	2	30,050	80,6	71,3	E N E	1,2	Do. do. do.
	3	30,026	80,6	72,5	N N E	1,2	Do. do. do.
	4	30,040	80,4	71,9	N E by E	1,2	Do. do. do.
	5	30,066	79,0	72,5	N E	1,2	Clear do. do.
	6	30,060	77,2	70,8	N E	1	Clear gentle wind.

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY; FOR THE MONTH OF OCTOBER, 1839.

Days.	Barometer at			Ther. at			Wet Bulb.			Rain.		Evaporation.	Direction of Wind.			Weather.			Remarks.
	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	Sun-rise.	Sun-set.		10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	
1839	Inch.	Inch.	Inch.	o	o	o	o	o	o										
Oct. 1	29,944	29,842	29,942	86,0	89,0	85,7	7,5	8,0	7,1	......	......	......	S W	S E	S W	Clear	Cloudy	Fl. cl.	lightning.—dew.
2	,974	,876	,980	85,0	89,6	86,6	6,4	6,6	6,0	......	......	2,650	W	W	S	Haze	Cloudy	Cloudy	do.
3	,994	,874	,984	86,0	89,5	84,9	7,5	7,5	8,9	......	......	......	S W	E	S	Cloudy	Cloudy	Do.	do.
4	,974	,860	,956	85,6	89,4	85,7	7,6	9,4	4,3	......	......	......	W	E	S	Clear	Do.	Fl. cl.	do. dew.
5	,960	,886	—	85,8	89,5	—	8,4	9.0	—	......	......	......	W	E	—	Do.	Fl. cl.	Haze	do.
6	,988	—	,968	86,3	—	86,6	5,1	—	5,4	......	......	......	S	—	S	Fly. cl.	—	Fl. cl.	do.
7	,990	,870	,954	85,6	88,5	86,8	7,3	7,6	5,2	......	......	......	S W	S	S W	Haze	Fl. cl.	Do.	do.
8	,988	,864	,950	85,1	89,0	86,2	7,1	5,5	4,0	......	......	......	W	S. SE	S	Cloudy	Fl. cl.	Do.	do. thun. in the evening.
9	,950	,838	,936	86,7	89,4	84,9	5,2	8,0	5,0	......	......	2,771	W	NE. E	N E	Clear	Th. hz.	Clear	do.
10	,950	,838	,922	87,0	88,5	83,2	8,0	8,5	2,6	......	......	......	E	E	E	Fly. cl.	Haze	Do.	do.
11	,950	,832	,912	85,9	88,0	81,3	5,9	8,0	5,1	......	......	......	W	E	S E	Haze	Th. hz.	Haze	do.
12	,942	,844	,902	86,4	88,5	82,9	6,4	8,0	3,1	......	......	......	S W	E	S W	Fly. cl.	Cloudy	Clear	do.
13	,940	—	,922	84,8	—	85,0	5,8	—	3,1	......	......	......	S W	—	S	Haze	—	Fly. cl.	do.
14	,950	,830	,930	86,0	89,0	85,0	6,5	7,0	6,0	......	......	......	S W	S E	S W	Do.	Fl. cl.	Cloudy	thunder & vivid lightning.
15	,960	—	,942	85,9	—	82,4	6,9	—	2,7	......	......	......	W	—	S E	Clear	—	Clear	lightning dew.
16	,966	—	,962	86,3	—	82,5	12,3	—	6,5	......	......	2,571	S E	—	E	Do.	—	Do.	do. do.
17	,994	—	30,010	84,7	—	83,9	7,2	—	8,4	......	......	......	W	—	E	Do.	—	Do.	do. do.
18	30,040	—	,014	84,8	—	83,3	7,8	—	7,3	......	......	......	S E	—	E	Do.	—	Do.	— do.
19	,050	—	,018	84,7	—	81,9	6,7	—	7,1	......	......	......	S	—	N E	Do.	—	Do.	— do.
20	,036	—	,000	84,9	—	82,0	7,4	—	—	......	0,215	......	S W	—	—	Fly. cl.	—	Do.	lightning. do.
21	,024	,916	29,973	84,3	86,8	82,0	6,3	8,3	—	......	......	......	E	E. SE	—	Fly. cl.	Clear	Do.	do. do.
22	,010	,909	,960	85,5	85,7	—	6,5	5,7	—	......	......	2,537	S W	E. NE	—	Fly. cl.	Fl. cl.	Do.	do. do.
23	,046	,943	—	85,1	85,6	—	5,6	12,1	—	......	......	......	E	E	—	Cloudy	Haze	—	do. do.
24	,066	,984	—	84,3	85,4	—	9,3	5,9	—	......	......	......	E	N E	—	Fly. cl.	Fl. cl.	—	do. do.
25	,084	,988	—	83,3	83,4	—	10,3	10,4	—	......	......	......	N E	N. NE	—	Haze.	Fl. cl.	—	do. —
26	,062	,961	—	82,8	85,0	—	5,8	8,0	—	......	......	......	N E	E	—	Fly. cl.	Th. hz.	—	— dew.
27	,017	—	29,980	83,3	—	81,9	5,1	—	6,7	0,345	......	......	W N W	—	E	Fly. cl.	—	Clear	lightning. dew.
28	,038	,954	—	84,0	86,0	—	5,0	7,5	—	......	......	......	N E	N E	—	Clear	Clear	—	do. dew.
29	,046	,966	30,050	84,8	85,7	84,6	5,9	7,2	5,1	......	......	......	N E	E. NE	N E	Fly. cl.	Fl. cl.	Clear	do. —
30	,100	,976	,036	83,7	84,3	82,8	4,2	6,8	4,8	0,432	......	2,924	S E	N E	N E	Cloudy	Cloudy	Fl. cl.	do. —
31	,080	,976	,050	84,0	84,5	82,3	4,5	8,0	4,4	......	......	......	N E	N E	N E	Do.	Fl. cl.	Cloudy	do, thunder.

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY; FOR THE MONTH OF NOVEMBER, 1839.

Days.	Barometer at			Ther. at			Wet Bulb.			Rain.		Evaporation.	Direction of wind.			Weather.			Remarks.
	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	Sun-rise.	Sun-set.		10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	
1839	Inch.	Inch.	Inch.	o	o	o	o	o	o										
Nov. 1	30,052	29,914	30,036	76,3	80,4	79,0	1,3	2,4	0,5	2,208	0,356	......	N	N by E	N W	Cloudy	Cloudy	Cloudy	—lightning and thunder.
2	,072	30,986	,038	75,1	77,7	78,4	1,6	1,4	1,7	1,147	0,864	......	N E	N W	N E	Rain	Rain	Cloudy	do. do.
3	,098	,000	,074	79,7	80,5	79,6	1,3	2,0	2,6	0,079	0,257	......	N	N. N W	S W	Driz. ra.	Cloudy	Rain	do. do.
4	,104	29,996	,062	78,0	81,0	79,5	0,0	2,0	1,4	1,798	0,637	......	N E	E.	E	Cloudy	Cloudy	Cloudy	do. do.
5	,106	,990	,050	77,6	78,6	77,8	0,1	0,6	0,2	0,947	0,874	......	N E	NwbyN	N	Rain	Cloudy	Rain	do. do.
6	,050	,965	,050	79,3	77,0	77,0	1,3	1,5	0,1	0,307	1,091	1,363	N	N E	N W	Cloudy	Rain	Cloudy	do. do.
7	,078	,947	,004	80,3	81,2	79,2	3,8	4,7	1,8	0,010	......	......	N	N N E	N	Fl. cl.	Cloudy	Fl. cl.	do. do.
8	,008	,910	29,986	76,8	78,0	77,6	0,7	0,0	0,6	0,122	2,516	......	N	N	N. N W	Cloudy	Cloudy	Cloudy	do. do.
9	29,968	,904	30,010	77,9	78,0	77,0	0,4	0,8	0,5	1,057	1,234	......	S E	N	SE. E	Cloudy	Cloudy	Cloudy	do. do.
10	,998	,900	29,988	76,6	79,6	77,0	0,1	1,6	0,4	0,467	......	......	Calm	Calm	N W	Cloudy	Cloudy	Cloudy	—lightning.
11	30,010	,885	,950	77,1	78,4	77,0	0,3	2,4	1,6	......	......	......	N W	N N W	N W	Rain	Cloudy	Cloudy	do.
12	29,996	,914	,990	77,5	77,2	75,8	2,5	1,2	0,2	......	......	......	N W	N N W	N. N W	Cloudy	Cloudy	Drizzling ra.	do.
13	30,012	,940	30,010	74,7	75,2	75,0	0,7	0,2	0,2	2,810	2,234	......	N W	N W	N W	Rain	Cloudy	Cloudy	—lightning.
14	,012	,898	29,972	77,2	80,0	75,3	3,4	7,7	2,8	0,094	......	2,312	N W	N	N W	Th. haze	Th. hz.	Fl. cl.	do.
15	29,972	,848	,910	78,1	79,6	76,0	12,1	10,6	6,0	......	......	......	N W	N W	N W	Haze	Th. hz.	Cloudy	——
16	,926	,812	,884	77,2	82,3	77,9	7,2	11,8	5,9	......	......	......	W	S W	S W	Clear	Haze	Haze	dew.
17	,940	,834	,946	77,8	82,5	80,5	6,8	5,0	3,5	......	......	......	S W	S W	S	Clear	Clear	Fl. cl.	do.
18	,968	,862	,968	79,9	84,4	80,2	5,7	5,9	3,2	......	......	......	S W	S E	S E	Clear	Clear	Clear	do.
19	30,026	,905	,986	81,0	84,3	81,0	5,0	5,8	3,4	......	......	......	S W	S E	S E	Clear	Clear	Quite cle.	do.
20	,010	,900	,976	81,2	84,0	80,4	4,2	7,0	4,4	......	......	2,075	S W	S E	Calm	Clear	Clear	Clear	do.
21	,008	,904	,994	81,6	82,4	78,4	3,6	3,9	2,9	......	0,160	......	S W	N. NE	N	Clear	Cloudy	Clear	do.
22	,052	,950	30,036	80,3	83,2	79,8	2,8	8,5	4,3	......	......	......	S W	E. NE	E	Clear	Clear	Clear	do.
23	,122	30,021	,120	80,4	82,0	79,3	4,4	11,3	3,9	......	......	......	N E	N. NE	N E	Clear	Clear	Clear	do.
24	,138	,050	,112	80,3	81,8	79,7	4,3	11,3	3,7	......	......	......	N E	N. NE	N E	Fl. cl.	Fl. cl.	Fl. cl.	do.
25	,164	,072	,150	81,7	82,0	78,0	8,2	9,5	5,5	......	......	......	N E	N E	N E	Fl. cl.	Fl. cl.	Fl. cl.	——
26	,158	,076	,162	80,9	82,0	80,5	6,9	6,7	6,5	......	......	......	N E	N E	N	Fl. cl.	Cloudy	Cloudy	——
27	,190	,098	,168	81,2	82,4	78,6	8,1	10,4	9,2	......	......	2,596	N	N E	N. N E	Cloudy	Fl. cl.	Clear	——
28	,168	,074	,150	78,8	81,0	79,6	7,3	10,0	9,6	......	......	......	N	N. NE	N. N E	Cloudy	Cloudy	Fl. cl.	——
29	,184	,076	,140	81,2	82,4	77,6	10,2	10,9	6,5	......	......	......	N E	E. NE	N E	Fl. cl.	Fl. cl.	Clear	dew.
30	,178	,076	,146	80,0	82,0	76,0	8,0	9,5	7,5	......	......	......	N E	N. E.	N	Clear	Fl. cl.	Fl. cl.	do.
Mean	30,059	29,957	30,036	78,9	80,7	78,3	4,1	5,6	3,4										

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY; FOR THE MONTH OF DECEMBER, 1839.

Days.	Barometer at 10 A. M.	Barometer at 4 P. M.	Barometer at 10 P. M.	Ther. at 10 A. M.	Ther. at 4 P. M.	Ther. at 10 P. M.	Wet Bulb. 10 A. M.	Wet Bulb. 4 P. M.	Wet Bulb. 10 P. M.	Rain. Sun-rise.	Rain. Sun-set.	Evaporation.	Direction of Wind. 10 A. M.	Direction of Wind. 4 P. M.	Direction of Wind. 10 P. M.	Weather. 10 A. M.	Weather. 4 P. M.	Remarks. 10 P. M.
1839	Inch.	Inch.	Inch.	o	o	o	o	o	o									
Dec. 1	30,196	30,100	30,174	80,0	81,5	79,0	10,0	8,5	9,5	......	......	......	N E	N E	N E	Cloudy	Fl. cl.	Flying clouds—dew—lightning.
2	30,188	,114	,240	79,6	83,0	78,5	10,6	13,3	5,0	......	......	......	N	N N E	N	Clear	Clear	Clear
3	30.194	,100	,182	81,0	82,0	79,2	9,6	10,5	7,7	......	......	......	N E	N E	N E	Clear	Clear	Flying clouds.
4	30,200	,102	,170	78,9	81,0	78,0	7,4	10.0	6,0	......	......	3,068	N E	N E	N	Cloudy	Cloudy	Haze.
5	30,220	,116	,182	79,1	80,0	76,0	9,6	10,0	5,0	......	......	......	N E	N E	N	Haze	Cloudy	Flying clouds.
6	30,210	,100	,180	78,2	80,0	77,8	9,0	9,0	4,8	......	......	......	N W	N N E	Calm	Cloudy	Fl. cl.	Haze.
7	30,180	,092	,142	79,1	82,5	78,2	5,8	10,0	1,9	......	......	......	N W	N N E	N E	Clear	Clear	Flying clouds.
8	30,156	,082	,104	79,9	82,0	77,7	7,9	10,0	6,2	......	......	......	N E	N E	N W	Fl. cl.	Clear	Clear—dew.
9	30,116	,030	,112	78,5	82,0	76,2	4·5	10,0	5,2	......	......	......	N W	N N E	N	Fl. cl.	Clear	Do. do.
10	30,144	,034	,132	78,7	80,0	77,4	5,5	7,0	6.7	......	......	......	N E	N N E	N E	Cloudy	Cloudy	Do.
11	30,136	.028	,124	78,5	81,5	77,9	5,2	10,0	6,9	......	......	2,678	N	N E	N E	Fl. cl.	Clear	Do dew.
12	30,092	29,968	,044	79,0	81,4	78,3	5,0	8,4	6,9	......	......	......	N W	N N E	N E	Fl. cl.	Clear	Flying clouds, dew.
13	30,080	,970	,040	80,1	81.5	78,0	6,1	9,5	6,3	......	......	......	N	N BY E	N E	Cloudy	Haze	Clear, dew.
14	30,092	30,012	,110	81,5	80,3	78,0	9,0	7,6	6,5	......	......	......	N E	N E	N W	Clear	Cloudy	Cloudy—lightning.
15	30,184	,040	,176	81,9	82,5	79,9	6,4	7,5	3,2	......	......	......	N E	N E	N E	Th. hz.	Cloudy	Flying clouds.
16	30,172	,068	,116	81,4	80,2	79,0	1,6	8,9	6,0	......	......	......	N E	N N E	N E	Fl. cl.	Cloudy	Thick haze.
17	30,118	,024	,114	80,0	80,5	79·0	10,3	6,5	4,5	......	......	......	N E	N N E	N E	Clear	Th. hz.	Clear—dew.
18	30,142	,055	,140	78,8	81,2	77,0	5,8	2,7	7,0	......	......	3,013	N E	N N E	N E	Clear	Fl. cl.	Fl. cl. do.
19	30,176	,080	,150	79,0	81,6	77,0	9,3	3,1	7,8	......	......	......	E	N N E	N E	Clear	Fl. cl.	Clear do.
20	30,166	,072	,148	79,6	81,5	77,8	9.7	11,0	6,1	......	......	......	N N E	N N E	N E	Fl. cl.	Clear	Cloudy—few drops of rain at 9 P. M.
21	30,174	,064	,130	79,0	78,8	75,7	5,2	8,3	6,2	......	......	......	N	N N E	N E	Fl. cl.	Th. hz.	Flying clouds—dew.
22	30,132	,040	,122	78,7	80,4	77,8	6,0	9,5	8,0	......	......	......	N	NE BY E	N E	Fl. cl.	Fl. cl.	Clear do.
23	,136	,012	,090	78,4	79,6	77,9	4,4	6,6	4,9	......	......	......	N E	N E	N E	Cloudy	Clear	Do. do.
24	,128	,032	,132	81,2	82,6	78,0	6,8	8,4	4,5	......	......	......	E	N E	N E	Fl. cl.	Fl. cl.	Cloudy
25	—	—	—	—	—	—	—	—	—	......	......	2,801	—	—	—	—	—	— dew
26	,084	29,970	,068	81,0	82,2	80,0	6,5	7,5	5,5	......	......	......	E	E S E	E	Fl. cl.	Clear	Clear do.
27	,098	,977	,064	81,5	82,8	80,3	7,9	8,3	1,8	......	......	......	E	E	E	Fl. cl.	Clear	Do. do.
28	,082	,969	,052	81,0	81,5	78,9	6,8	8,5	3,9	......	......	......	E N E	E	E	Fl. cl.	Fl. cl.	Do do.
29	,066	,970	,074	80,3	81,9	78,9	6,3	8,4	5,1	......	......	......	N E	E	E	Fl. cl.	Fl. cl.	Flying clouds do.
30	,116	30,012	,126	80,8	82,8	79,7	6,6	10,1	6,7	......	......	......	E	E	E	Fl. cl.	Clear	Clear do.
31	,202	,078	,172	79,3	82,6	79,6	6,2	10,1	6,1	......	......	......	E	E	E	Fl. cl.	Clear	Flying clouds do.
Mean	30,146	30,044	30,107	80,1	81,4	78,3	7,0	8,6	5,7									

The Instruments with which the foregoing observations are made, are placed in the Western Verandah of the Honourable Company's Observatory; at about 5 feet above the surface of the ground, and 27 feet above the level of the Sea; the thermometer was made on purpose for the Observatory, and at 75° (the only point at which a comparison has been made) it was found to differ insensibly from the Royal Society's Standard; the barometer is one of two Standards which I have lately constructed, and may be depended upon to 0,0100 an inch.

T. G. Taylor,
H. C. Astronomer.

MADRAS JOURNAL

OF

LITERATURE AND SCIENCE.

No. 27—*April* 1840.

I.—*Catalogue of the Birds of the Peninsula of India, arranged according to the modern system of Classification; with brief Notes on their Habits and Geographical Distribution, and description of new, doubtful and imperfectly described Species:—By* T. C. Jerdon, *Assistant Surgeon, 2d Madras Light Cavalry.*

(Continued from No. 26 *page* 80.*)*

Tribe SCANSORES.

Family PSITTACIDÆ.—*Parrots.*

Sub Family MACROCERCINÆ.—*Long tailed Parrots.*

Genus PALÆORNIS.—*Ringed Parrakeet.*

200.—*P. torquatus*, Vigors.—*P. cubicularis*, Wagler.—*Ps. torquatus*, Gmel.—*P docilis*, Vieill.—Perhaps also *P. bicollaris* of the same—*Lybur Totah*, or *Totah*, H.— *Common red-ringed Parrakeet.*

This parrot is one of the most common and abundant birds in India, frequenting the cultivated ground and gardens in all parts of the country, even the most bare and open. It is very destructive to various kinds of grain and fruit. It associates in flocks of various size, sometimes very numerous, roosting in the holes of old trees, and flying forth to their various feeding haunts, early in the morning. When the grains are cut and fruit is scarce, it often takes long flights in search of any fruit-bearing trees, skimming close to the large trees, and when successful in its search, in general not alighting suddenly, but taking a short circle, and changing its usual mode of flight, viz. a swift and continued flapping of their wings, to a steady sailing with wings spread and turned obliquely downwards, and thus alighting on the tree speedily commences its meal. Its flight is very swift, and it generally keeps up a harsh scream when in motion. It is, however, at all times a noisy bird. It breeds in holes of trees during the hot weather, laying as I am credibly informed, 3 or 4 white eggs.

Irides light yellow; bill lively red above, dusky beneath. Length 16 to 18 inches; wing 7; tail 10 to 11.

201.—*P. Alexandri,* Vig.—*Psitt. Alexandri,* Auct.—*Raee-Totah,* H —*Large red-ringed Parrakeet.*

This species is much more rare than the last, and I have only seen it on two or three occasions. The first time I became aware of its being found in the peninsula was seeing one carried off in an open space in the jungles of Malabar by a Shaheer *(Falco Aldrovandi)*, which dropped it on my firing at it, and I picked it up, severely wounded but still alive. I have again seen it once or twice in the neighbourhood of well wooded villages, in the northern part of the table land, and obtained 4 young ones from the nest, in a hole of a lofty tree, last December. As I am informed by shikarees that it is not very uncommon in some of the more wooded districts, I dare say I have occasionally overlooked it, mistaking it for the last; still it is comparatively so rare, that I think the previous species was most probably the one taken first to Europe from this country, and which therefore should have been named *P. Alexandri.* It breeds during the cold season.

Length about 20 inches; wing 8½; tail 12; bill deep cherry red above, lighter and more orange red beneath; feet cinerous.

202.—*P. Bengalensis,* Vigors.—*Psitt. Bengalensis,* Gmel.—*P. erythrocephalus,* Gmel.—*P. flavicollaris,* Frankl.—*Yellow collared Parakeet,* Lath. Young bird.—*Tooeeah Totah,* H.—*Red-headed ringed Parakeet.*

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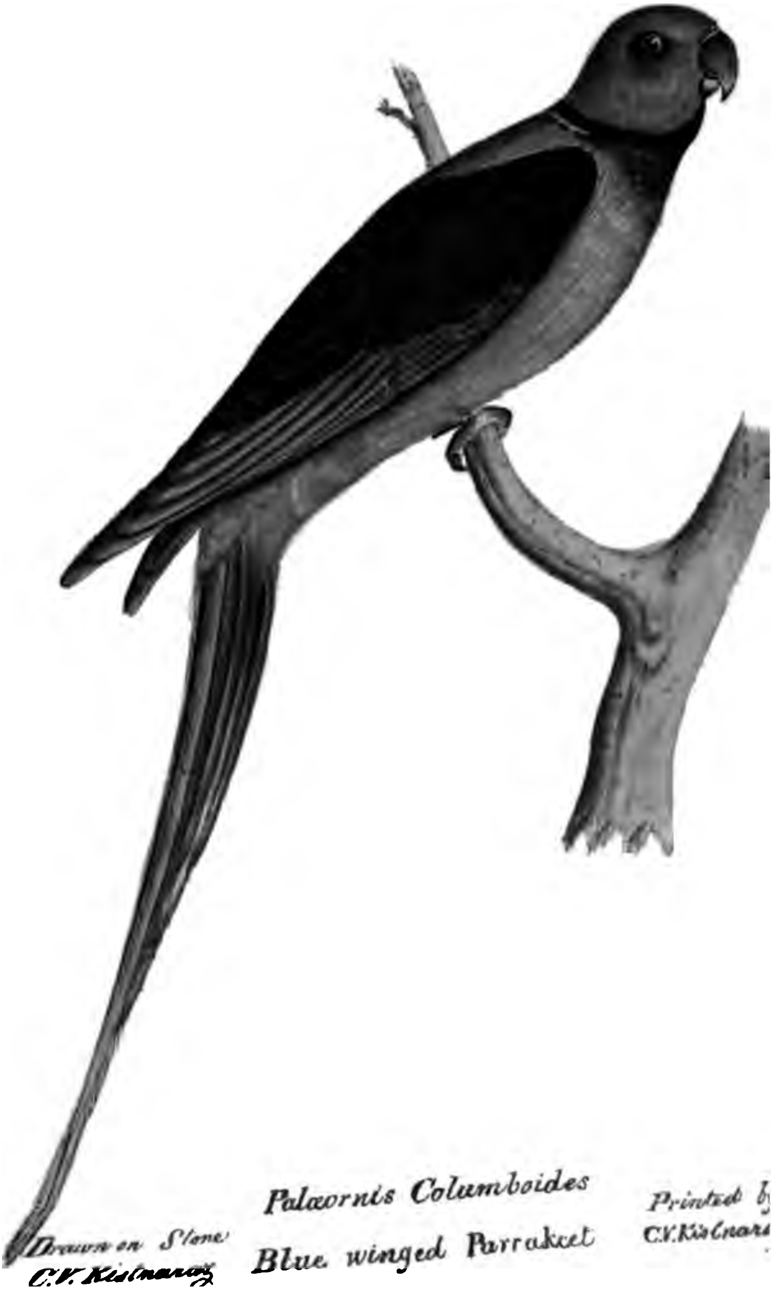


Palæornis Columboides

Blue winged Parrakeet

Drawn on Stone
C.V. Kistnaraz

Printed b
C.V. Kistnar

This lovely species is never found in the open country, being a denizen of open jungles, and also found in the clearer spaces of the denser jungles. I have seen it in Goomsoor; also brought from the jungles of the Tondiman's country in the Carnatic; on the west coast, not uncommon; and even occasionally in low jungly districts in the Deccan. It has the same habits as others of the genus. The *P. flavicollaris* of Franklin, or *plum-headed Parakeet* is always found in the same localities as the *red-headed Parakeet*, and is considered as the young bird by shikarees and others; so, though I have not seen the actual change, yet as the size and structure agree, I have no doubt that it is the same bird.

The three last species are frequently taken when young and caged, learning to repeat words and sentences with facility, and becoming very tame.

Irides light yellow; bill reddish yellow above, beneath blackish. Length 14; wing 5½; tail 8 to 8½.

203.—*P. Columboides*, Vigors.—*P. Melanorhynchus*, Sykes—young bird.—*Muddun Gowr Totah*, H.—*Blue-winged Parrakeet.*

This very elegant and chastely coloured *Parrakeet* is found only in the dense and lofty forests of Malabar, as well below the ghauts as on them, attaining, as I have observed on the sides of the Neilgherries, a height of nearly 5000 feet. Its usual call is less harsh than that of the other species. I have not yet seen it domesticated. I have shot the *P. melanoryhnchus*, always in company with the others, and consider it as the young bird. Whether the adult female retains the black bill or not, I do not know, as the specimens with red bills shot by me were all male birds.

Like the other species it feeds on fruit and berries of various kinds.

Irides light yellow; feet cinerous; bill lively red above, dusky beneath. Length 15—16 inches; wing rather more than 5½; tail 8½ to 9.

SUB FAMILY LORIANÆ.—Swains.

GENUS PSITTACULUS.—Khul, Selby.—*Lorikeet—Dwarf Parrot.*

204.—*Ps. vernalis*, Swains.—*Bhora* or *Bhoăra*,' H.—*Red-rumped Dwarf Parrot*, or *Lorikeet.*

I am convinced that Swainson was right in separating this species from the allied one, *P. galgulus*, for I have shot many of both sexes, and seen numerous specimens, none of which showed any approach to the plumage of the other. I have found this species only in the more open spaces of the lofty jungles of the west coast. It is most numerous, I think, in Travancore, and the more southern portions; also at the foot of the Neilgherries. I did not observe it at any considerable elevation, but I see it is enumerated in Mr. Elliot's Catalogue, as found in the Southern Mahratta Country, but only during the rains. It is found in small flocks, and while feeding keeps up a continual feeble chirping. I am informed by a gentleman who was for some time in Malacca, that either this, or an allied species (perhaps the *P. galgulus*), was often domesticated there, and that it had the same custom of sleeping with its head downwards, which the *Colies* (*Gen. Colius*) are represented to have. I found in the stomach of several birds a soft pulpy vegetable mass with a few seeds.

Irides whitish yellow; bill and legs orange. Length about 6 inches; wing rather more than 3½; tail 1¾.

FAMILY PICIDÆ, Swains.—*Woodpeckers.*

SUB FAMILY PICIANÆ, Swains.—*True Woodpeckers—Lulkurphor*, H.

GENUS PICUS.—*Typical Woodpeckers.*

SUB GENUS PICUS, Swains.

205—*P. Strictus*, Horsf. Lin., Trans. vol. xiii.—*P. Peralusimus*, Wagler.—*P. Goensis*, Auct. (bad description).—*Scarlet-backed Woodpecker.*

This handsome *Woodpecker* is found only in the dense and lofty forests of the west coast, occasionally seen below the ghauts, but most numerous on the more elevated wooded regions, and frequently seen on the summit of the Neilgherries, in the thick woods there. Its habits do not differ from those of others of the genus. The *Scarlet-backed*

Woodpecker appears to belong to the most typical group of woodpeckers, and is the only one of that group I have yet seen from the peninsula. It is apparently a slightly aberrant species, leading to *Hemicircus* by its short neck, and short and broad tail. The female is said by Horsfield (fid. Wagler) to differ from the male in having the feathers of the head and crest orange, instead of scarlet. The only female I procured, has the whole of the head and crest of a sooty black, each feather ended with a white drop at its termination. This, however, may have been a young bird. Irides yellow; bill blackish lead colour; feet plumbeous.

Length about 12 inches; wing 6; tail 3 inches; bill to front $1\frac{5}{10}$th, straight to gape $1\frac{8}{10}$th; breadth at base above $\frac{5}{10}$ths; anterior toe (without claw) $\frac{8}{10}$ths; versatile do. 1 inch.

The tale of this woodpecker differs from that of most others of the family, in having the 4 centre feathers equally elongated, and all exposed when the tail is closed, instead of the 2 centre ones only, as is the case in most other species. The ends of all four are very much worn, so that the barbs on either side extend a fifth of an inch beyond the shaft. Its head is very broad also, and the whole body indeed is remarkably thick and robust.

SUB GENUS HEMICIRCUS Swains.

206.—*H? cordatus.*—New species?—*Heart-spotted Woodpecker.*

Descr.—Male, forehead and head, interscapular region, back, and rump, shoulders, wing coverts, chin, throat, and stripe from lower mandible running below the ears, of a light whitish yellow; the feathers of the wing coverts with a black heart-shaped spot at their termination. Face, cheeks, long occipital crest, nape, scapulars, quills, upper and lower tail coverts, vent and tail, deep black. Beneath from throat to the vent, dull green. On the centre of the back is a brush of dark sap green feathers, rough and somewhat bristly, and some of them smeared with a viscid secretion. Bill bluish black; legs greenish black. Irides brownish red. Length nearly 6 inches; wing $3\frac{3}{4}$; tail $1\frac{4}{10}$ths; tarsus $\frac{7}{10}$ths; anterior external toe $\frac{4}{10}$ths; versatile toe nearly $\frac{6}{10}$ths; bill to front $\frac{6}{10}$ths, at gape $\frac{8}{10}$ths. The female differs from the male only in the forehead and head being black, the feathers tipped with very minute whitish spots. This very singular little woodpecker, which is undescribed in Wagler's Monograph of the genus, appears to belong to Swainson's sub-genus *Hemicircus*, by its circle; bill horny above, yellowish at the base and beneath; feet ish slaty. Length nearly 12 inches; of wing 5$\frac{8}{10}$ths; tail 3¾; front 1$\frac{3}{10}$ths; at gape 1$\frac{6}{10}$ths.

In the female the head is black where it is red in the male.

211.—*B. mentalis.*—*Picus mentalis*, Temm. P. C. 384? Cuv. p. 444).—*P. chlorolophus*, Vieill., Encyl. Meth., young bird? and *Yellow-crested Woodpecker.*

The brief description in Griffith's Cuvier of the *P. ment* Temminck, appears applicable to specimens I have obtained fro western coast, with the exception that the throat is *not* black.

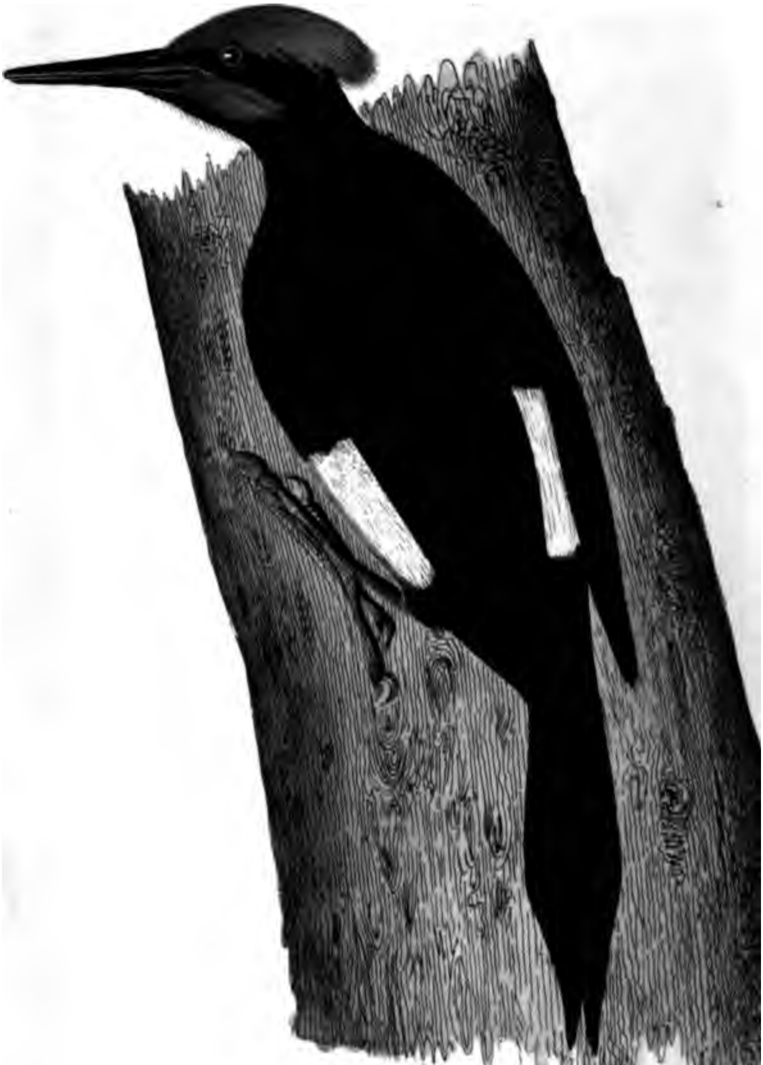
It is a rare bird. I have only seen it on two or three occasion litary in thick forest jungle in Travancore and Malabar. It mentioned in Mr. Elliot's Catalogue. However I shall here brief description. Head and cheek stripe red, a short occipital of same colour terminated by bright yellow: plumage above green; beneath dull sap green; the feathers banded and spotted white. Wings greenish, with a strong orange tinge; and the ex barb of most of the quill feathers of a deep orange red, inte dusky, with white spots; tail unspotted black; bill slaty, greeni neath; legs sap green. Irides reddish brown. Length 9—9½ in wing 4$\frac{8}{10}$ths; tail 3$\frac{2}{10}$ths; bill to front $\frac{8}{10}$ to $\frac{9}{10}$ths; at gape 1

One specimen, probably the female, differs in having the forehea head green, instead of red, and wants the red cheek stripe. *P. chlorolophus* of Vieillot is probably the young bird, or it may b female. The colouring of this species somewhat resembles that *P. Nepalensis* of Gray, figured in Hardwicke's Ill. of Ind. Zool.

212.—*B. Bengalensis.*—*P. Bengalensis*, Auct.—*P. aurantius*, (bad description).—*P. nuchalis*, Wagler.—*Brach. hemipodius*, Swa *P. chrysonotus*, Lesson?—*Orange* and *black Woodpecker.*

This is perhaps the best known of all the peninsular species, found wherever there is plenty of wood or high jungle, and ev groves and gardens in the vicinity of well wooded towns, as I hav in the Northern Circars and Carnatic. On the bare table land, I not yet observed it, but it is tolerably plentiful on the west coast in the wooded regions on the summit of the ghauts. It is gen seen single or in pairs. From its extensive distribution over In would be advisable to change its local name, either to the stru name of Swainson, or the one lately proposed by Wagler.

Irides crimson; bill blackish; legs plumbeous. Length nearl inches; wing 5¼; tail 3; bill to front 1$\frac{1}{10}$ths; at gape 1 $\frac{6}{10}$ths.



Drawn on Transfer Paper by
J Dunphy

Picus Hodgsonii.

Printe
W. Winck

SUB GENUS HEMILOPHUS, SW.

213.—*H. Hodgsonii.*—New species?—*Large white-backed Woodpecker.*

Descr.—Head, short thick crest, and stripe running from the base of the lower mandible, crimson; lower part of back, rump and middle belly white; rest of the plumage deep black; bill black; legs dark plumbeous.

Length 19½ inches; wing 9; tail 7½; tarsus 1½; bill to front 2 $\frac{3}{10}$ths; at gape 2 $\frac{8}{10}$ths; width at base ½ inch; the tail is much wedged; wing with 6th quill longest; 7th equal to the 4th.

This splendid Woodpecker, apparently undescribed, appears to approach in colour the *P. Javensis* of Horsfield, the *P. leucogaster* of Temm. and *P. pulverulentus* of the same, but differs according to their description by the accurate Wagler, as well in size, as in some markings, especially the white of the back, which the above named species want. It is second in size only to the lately discovered *Chilian* species (*P. imperialis* of Gould), being about equal to the *P. principalis* of America; and though inferior in typical attributes to the *P. Sultaneus* of Hodgson, is yet its superior in size. I have seen it but rarely in the most dense and lofty forest jungle, and being exceedingly wary, I did not procure a fresh specimen, but through the kindness of Mr. Vaughan, Circuit Judge at Tellicherry, I obtained a fine stuffed specimen. I have named it in honour of Mr. Hodgson, Resident at the Court of Nepal, whose name is too well known to require here any further encomium from me.

SUB GENUS MEIGLYTES, SW.

214.—*M. badius?*—*P. badius*, Raffles.—*P. brachyurus*, Vieillot and Wagler.—*P. rufus* of Gray and Hardwicke, Ill. Ind. Zool. (not of Wagler and other authors).—*Bay Woodpecker.*

This curiously plumaged Woodpecker is a rare species in the peninsula. I have seen it in thick forest in the Wynaad, and also in an avenue in Malabar, in the close proximity of thick jungle. Mr. Elliot also met it in the Southern Mahratta Country, and in his notes says, "Is remarkable for the head being generally smeared, as also the scapulars and tail, probably from the gum of some tree."

Irides brown; bill blackish; legs slaty. Length about 10 inches; wing 4 $\frac{8}{10}$ths; tail 2 $\frac{8}{10}$ths; bill to front nearly $\frac{9}{10}$ths; at gape 1 $\frac{2}{10}$ths.

SUB GENUS CHRYSONOTUS, Sw.

215.—*C. tiga.*—*P. tiga,* Horsf. and Wagler.—*C. tridactylus,* Sw.—*Crimson-backed Woodpecker.*

This very elegant Woodpecker is found in the forests of the western coast, both at a low level and as high as 5000 feet, at which height I have seen it on the Coonoor pass of the Neilgherries. The specimens shot below the ghauts are considerably smaller than those I obtained at a great elevation, which latter attained the size of *P. Shorii* of Vigors, though not differing in colour from the smaller ones.

Irides fine crimson; bill and legs dark slaty. Length varies from 9½ to nearly 12 inches; of one of the latter size the wing is 5½; tail nearly 4; bill to front 1 inch; at gape 1 $\frac{4}{10}$ths; of one 9½ inches; the bill to front is $\frac{8}{10}$ths; at gape 1 $\frac{1}{10}$th.

SUB FAMILY BUCCOINÆ, Sw.

GENUS BUCCO, L.—*Barbet.*

216.—*B. Indicus,* Lath.—*B. Philippensis,* Gmel. P. E. 333.—*B. flavicollis,* Vieillot.—*B. rubricapillus,* Lath. (from Brown, Illust. pl. 14.)—*B. luteus,* Lesson, albino variety.—*Kut-Khora,* H—also *Tambayut* i. e. *Copper-smith,* which name it receives also from some European residents.—*Red-crescented Barbet.*

The *Copper-smith* is extremely common in all parts of the country, wherever there are a sufficiency of trees, inhabiting open spaces in the jungles (never in the denser portions), groves, avenues, and gardens; being very familiar, approaching close to houses, and sometimes perching on the house top. As far as I have observed, it does not climb like the woodpeckers, but when feeding, hops about the branches like a perching bird. Though I never detected this *Barbet* tapping like the woodpeckers, I have once or twice had good reason for supposing that it does so occasionally. The chief food of the *Copper-smith* is fruit of various kinds, sometimes insects. When not employed in feeding, it generally seats itself on the very top of a tree, and gives utterance to its monotonous call of '*took took took*' (as represented by Sykes), nodding its head at each call, first to one side and then to the other.

Irides lake red; bill black; legs red. Length 6½ inches; wing 3 $\frac{3}{10}$ths; tail 1½; tarsus $\frac{7½}{10}$ths; bill at front nearly $\frac{7}{10}$ths; at gape 1 inch.

217.—*B. viridis*, Gmel.—*B. zeilanicus*, Lath.—Brown, Ill. Zool. pl. 15., Le Cabezon.—*Kettorea*, Vieillot.—*B. Lathamii*, Vieillot, Encly. Meth. —*B. caniceps*, Franklin, Cat.—*Kootoomra*, H. of some shikarees.—*Kootoorga*, Mahr.—*Kootur Kakee*, Can., all named from its call.—*Brown-headed Barbet.—Jungle Barbet.*

This *Barbet* is found throughout India, only in the higher jungles, and is therefore of course most abundant on the west coast, where it is found from the level of the sea to the top of the Neilgherries, where it is more abundant than in any other locality I have visited. There is a very remarkable variation in the size of this species, the largest specimens being found on the Neilgherries, and degenerating in size, as you approach the coast. From Mr. Elliot's notes I extract the following interesting observations—" Seldom seen on the wing; but single birds heard on almost every tree, uttering their peculiar note which resembles the native (Canarese) name, being a continued *Kŏoturr Kŏturrr*, or *K'turrr*. They continue to call for some minute at a time, and are heard throughout the day. On each side of the throat is a naked spot with skin wrinkled, which is probably contracted and expanded when the bird is calling." This bird does not climb like a woodpecker, and I never heard any tapping from the trees it frequents. Its most general food is fruits and berries, occasionally it eats various insects. Mr. Elliot says " one was shot picking at the flowers of a small tree."

Irides reddish brown; bill and legs pale horny brown.

Length varies from hardly 8 to 10 inches; of the largest one, the wing is 4½; tail nearly 3; tarsus $1\frac{2}{10}$ths; and bill at gape $1\frac{8}{10}$ths. In the smallest, the bill is only $1\frac{2}{10}$ths; wing 4; and tail 2½ inches.

Genus YUNX.—L.

218.—*Y. torquilla ?.—Wryneck.*

Mr. Elliot obtained a single specimen of this bird, or a nearly allied species, in the middle of the month of April, in the Southern Mahratta Country. It was seated on the ground in the bed of a dry tank. I have never seen it, and add Mr. Elliot's description for the sake of comparison.

"Above of a beautiful speckled grey, with a broad irregular dark line from the crown to the middle of the back; so dark in parts as to appear almost like black spots. Cheeks and throat pale yellowish, with narrow transverse bars, which are also continued on the chin, which has a white ground. A dark broad line runs from the eye to the ear, and another darker, narrower, and better defined down the side of th throat. Breast and upper belly white, with small triangular blac spots; wing coverts have a yellowish tinge. The quills are barred wit brown and isabella. Rump and tail speckled; the former with blac longitudinal streaks, the latter with 3 darker, broad bands, and partiall edged with black. Bill straight, round, pointed—legs shielded, of greenish horn colour. Irides crimson.

Length nearly 7½ inches; tongue long as in the woodpeckers."

Family CERTHIADÆ.—*Creepers.*

Sub Family SITTINÆ.—*Nuthatches.*

Genus SITTA.—L.

219.—*S. castaneoventris*, Franklin, Cat.—*Chesnut-bellied Nuthat*

I have hitherto seen this *Nuthatch* but on one occasion, which I s in Goomsoor, in high forest jungle. I have, however, seen specim shot at the top of the Guzzlehutty pass, in Mysore.

Length 5½ inches; wing 3; tail 1½; tarsus $\frac{7}{10}$ths; bill at fro $\frac{6\frac{1}{2}}{10}$ths; at gape $\frac{9}{10}$ths; bill black; legs plumbeous brown.

Genus DENDROPHILA, Sw.—*Social Nuthatch.*

220.—*D. frontalis.*—*Sitta frontalis*, Sw., Zool. Ill.—*S. velata*, Temm P. C.—*Velvet-fronted blue Nuthatch.*

This lovely little Creeper is found in great abundance in the den woods of the Neilgherries. I have seen it, though rarely, below th ghauts, also in thick forest jungle. It hunts, in general, in small pa ties of five or six; is very active and restless, creeping round the ho zontal branches chiefly, and seeming to prefer the under side of t branches, and also running downwards. It feeds on various sma insects, which it picks off the bark, but does not tap like the comm *Nuthatch.*

Irides light yellow; bill orange. Length 5 inches; wing 3; tail 1 bill to front $\frac{4}{10}$ths; at gape $\frac{8}{10}$ths; tarsus hardly $\frac{7}{10}$ths; hind toe wi out claw ½ an inch.

FAMILY CUCULIDÆ—*Cuckoos.*

SUB FAMILY CUCULINÆ, SW.—*Parasitic Cuckoos.*

GENUS CUCULUS, L.

221.—*C. canorus*, L.—*Cuckoo* of Europe.

The European *Cuckoo*, said by Franklin to be so common in Bengal, is rarely met with south of N. lat. 20. Its well known note was frequently heard in Goomsoor. Colonel Sykes too mentions it as found, though rarely, in the Bombay Deccan, and I obtained a specimen of what, I conceive, may be the young of this bird, as far south as the Tapoor pass (N. lat. 11°), and have seen the same bird apparently once or twice in wild jungly districts on the table land. I add a brief description of my bird, as I am by no means certain that it is the same as the European *Cuckoo.*

Descr.—Above brownish cinereous, the feathers all edged with white; beneath white, transversely barred with dusky brown; bill blackish; yellow at base; legs, toes and claws yellow.

Length 14 inches; wing 8$\frac{3}{4}$; tail 7; tarsus $\frac{8}{10}$ths; bill to front $\frac{7}{10}$ths, at gape 1 $\frac{2}{10}$ths. Should my bird prove to be a different species from the European *Cuckoo*, it is perhaps the *C. tenuirostris* of Lesson.

222.—*C. fugax*, Horsf.—*Bychan Cuckoo*, Lath.—*Koopuk*, H.—*Oopuk*, of some.—*Pipeeha* in Bengal from its note.—*Indian Cuckoo.*

The Indian *Cuckoo* is found all over the peninsula in the more wooded districts, not only in thick jungles but also in groves and gardens. It is very numerous in the thickly wooded western coast, and its loud, shrill crescendo notes, very similar to those of the *Koweel*, are heard in every avenue. It flies very like the *Shikra*, and it is frequently pursued by small birds, probably under that impression. The *Koopuk* lives chiefly on fruit, especially the fig of the banian tree, occasionally, however, on caterpillars, and other soft insects. I extract the following from Mr. Elliot's notes regarding its peculiar cry: " The note is *whe-wheewa, whe-wheewa, whe-wheewa*, uttered 8 or 10 times, and sometimes oftener. The first syllables lower, gradually rising till the last become extremely loud and shrill."

The dark spots on the breast and belly of this bird, have the same character as those of the hawks, being longitudinal in the young bird, and becoming transverse with age.

Irides bright yellow; bill brown; yellowish at the base; gape, eyelids and feet, of a deep bright yellow. Length 13 inches; wing 8; tail 7 tarsus $\frac{9}{10}$ths; bill to front $\frac{8}{10}$ths; at gape 1 $\frac{8}{10}$ths.

223.—*C. Himalayanus*, Vigors. Gould's Cent. Him. Birds.—*C tenuirostris*, Gray and Hardwicke's Ill. Ind. Zool.—*Small Bay Cuckoo.*

This very elegantly marked *Cuckoo*, supposed to be confined to the Himalayan mountains, is found, though rarely, all over the peninsula, in thick forest jungle. I have observed it once or twice only, in Malabar, and in the Coonoor ghaut, but have seen specimens from Travancore, where it appears tolerably abundant, and also from the eastern range of ghauts, about the lat. of Madras. The stomach of the only specimen I shot, contained caterpillars.

Length a little more than 10 inches; wing 5; tail 5; tarsus $\frac{6}{10}$ths; bill to front $\frac{7}{10}$ths; at gape rather more than 1.

224.—*C. flavus*—Gmel., Lesson Traité p. 151?—*C. honoratus*?—*C. Sonneratii*?—*C. lugubris*, Horf.?.—*Powsya*, Mahr.—*Plaintive Cuckoo.*

Among the imperfect descriptions of authors it is often difficult to determine correctly many species, but when the changes of plumage of the bird are themselves considerable, the difficulties are greatly increased. Such is the case with regard to the bird I am now going to mention. The *Plaintive Cuckoo*, as it may be appropriately named, is an inhabitant of the western coast of the peninsula, and is found alike in thick jungle, and in the more open spaces, and even in gardens and avenues. Though I frequently heard it, I only obtained two specimens, and am indebted to Mr. Vaughan for the examination of a third. I have neither seen nor heard it in any of the other districts of the peninsula. It is found at all levels from that of the sea, to the top of the Neilgherries, about Coonoor and Kotagherry, where it is found in thick bushy ground. Like the other cuckoos it is found single or in pairs. It has a most sweet and plaintive note, which is often heard, and which sounds something like the last syllable, being *whĕ-whĕw, whe-whĕ-ĕ·w*, much lengthened out, and very plaintive. I found its food to consist chiefly of caterpillars. I shall add a brief description of the three birds I have had the means of observing.

The first is entirely of a dark cinereous tint, with a strong gloss of green throughout; tail blackish, edged with rufous; quills beneath cinereous. A second specimen has the same glossy green colour above, with the exception of the rump (which is lighter cinereous without any green), and the forehead, which also is nearly devoid of the green, chin and throat cinereous; breast darker do. banded with rufous and white; belly pale cinereous, faintly marked with pale rufous and white; under tail coverts white; tail black; the inner webs banded with white (except the 2 centre ones), and all tipt white.

Another specimen has the plumage above entirely cinereous, with a slight indication of the greenish gloss on the wings only. Tail as in the last, beneath pale cinereous, vent and under tail coverts white, quills with a broad white band on their internal webs.

Irides, in one specimen (the last) of a fine ruby red. In the first one of a blood red, bill blackish red beneath (at the base), also at the gape and internally; feet reddish.

Whether this bird is identical with *Cuc. flavus* of Gmel. or a different species altogether, I leave to be decided hereafter.

Length 9 inches; wing 4½; tail 4½; tarsus $\frac{7}{10}$ths; bill to front $\frac{6}{10}$ths; at gape $\frac{8}{10}$ths.

225.—*C. dicruroides.*—*Pseudornis dicruroides*, Hodgson, Journal A. Soc. of Bengal, No. 86. p. 136.—*Drongo Cuckoo, or Black fork-tailed Cuckoo.*

This most extraordinary species of *Cuckoo*, disguised so effectually in the garb of the common *King Crow* (*Dicrurus*), has been lately described and figured by Mr. Hodgson, in the Journal of the Asiatic Society of Bengal. I obtained a single specimen in the Wynaad, near Manantoddy, and never again observed it. As Mr. Hodgson's paper may not have been seen by some of the readers of this Journal, I add his description—" Black with a changeable blue or green gloss—inner wing and tail coverts, and pair of extreme tail feathers, cross-barred with white. An oblique white bar across the wings internally, and high up. Bill black. Irides hoary brown; palate red. Legs and feet blue, 10 to 10½ inches long; bill 1 $\frac{1}{10}$ th; tail 5½ to 5¾; tarsus $\frac{8}{10}$ths. Long anteal toe $\frac{11}{10}$ths; long posteal do. $\frac{9}{10}$ths; weight 1½ oz. Sexes alike, exclusively monticulous and a forester. Tail of 10 feathers divaricated and forked. The two extreme feathers smaller than any of the rest." Mr. Hodgson further says that " the *cuculus lugabris*, will I think, be found to have a forked-tail, and to constitute a second species of our proposed new genus."

I can only add to this, that in my specimen the legs were reddish, as in the last species, and that the wing is 5 $\frac{8}{10}$ths long. Irides also were reddish brown. I may mention that I had in my manuscript notes named this bird " *dicruroides*" or ' *dicruricaudus*,' a name which its extraordinary resemblance could hardly have failed to suggest, and which was glad to see that Mr. Hodgson had also adopted. Does this *Drong Cuckoo* select the nest of the *Dicrurus* to deposit its eggs in? If so the foster parents would hardly be undeceived even when their progen were arrived at maturity.

Genus OXYLOPHUS, Swains.—*Crested Cuckoo.*

226.—*O. edolius.*—*Cuc. edolius*, Auct.—*C. afer* and *C. serratus*, Gm.—*C. melanoleucos*, Gmel.?—*Leptosomus afer*, of Franklin and Sykes' Cat logues.—*Popeya*, H.—*Black* and *white-crested Cuckoo.*

The *Popeya* is distributed over all India, but cannot be said to be common bird any where. It is of course most numerous in the mo wooded districts. I have seen it in the Carnatic, Malabar Coast, a even on the bare Deccan, in low jungle or among gardens. It hu single or in pairs, and feeds chiefly on various soft insects, &c. the Neilgherries I have seen it occasionally about the edges of hills, frequenting the thick bushy ground there.

Length 13 inches; wing 5½; tail 6½; tarsus 1 $\frac{1}{10}$th; bill to fr $\frac{9}{10}$ths; at gape 1 $\frac{1}{10}$th.

227.—*O. Coromandus.*—*Cuc. Coromandus*, Lath.—*Cuc. Collaris* Vieill.

I possess but one specimen of this bird, which I obtained alive at Madras, and have never seen another of the kind.

Genus EUDYNAMYS, Vigors and Horsf.—*Thick-billed Cuckoos.*

228.—*E. orientalis.*—*C. orientalis*, Lin.—*C. mindanensis* (the female) also according to Lesson.—*C. scolopaceus.*—*C. crassirostris.*—*C. pun tatus* and *C. maculatus* of authors.—*Koweel*, H. Fem.—*Koreyal i. e. spotted Koweel.*—*Koweel* of Europeans in India.—*Black Cuckoo.*

This well known bird is found in all parts of the peninsula, wher there are a sufficiency of trees. It is common in the Carnatic in groves, gardens and avenues, and also in the west coast, but rare in the bare table land. It feeds entirely on fruit, and is remarkably fond of the fig of the banian tree. It has a most peculiarly shrill and piercing call of two syllables, repeated frequently, and every time with increased vigour, so that at the finale it is most piercingly loud. The *Koweel* (as is well known in India) lays its eggs in the nest of the common crow (*Corv. splendens*), from which it dislodges the crow's eggs. It is said always to choose this crow's nest. On one occasion I obtained an egg from the female *Koweel*, it was of a dirty blue colour, marked with some dusky spots.* Irides fine blood red.

Length of male 15½; of female 16½; wing of latter 7¾; tail 7½; bill at gape 1 $\frac{4}{10}$ths.

GENUS XANCLOSTOMUS, SW.—MELIAS, LESS.—PHOENICOPHAUS, Auct.

229.—*X. viridirostris.*—New species?—*Melias tristis*, Less.?—*Melias diardi*, Less.?—*Cuc. Sumatranus*, Raffles?.—*Green-billed Cuckoo.*

I cannot find in Lesson or Cuvier a description of this *Cuckoo*, though that of the *Melias tristis* and *M. diardi* of Lesson, somewhat approaches it. It differs, however, in several particulars from either, and especially in size.

Descr.—Above blackish cinereous, with a tinge of green; wings and tail glossy green black, the latter tipped with white; beneath light greyish, with a tinge of fawn colour, and mixed with blackish on chin and throat.

Irides fine blood red; naked eye-spot cobalt blue; bill beautiful apple green; legs and feet greenish black. Length about 15 inches; of which tail is 10; wing 5½; tarsus 1 $\frac{3}{10}$ths; bill to front 1 inch; at gape 1 $\frac{3}{10}$ths.

The *Green-billed Cuckoo* is found over all the peninsula, but it is an uncommon bird, except in some few localities. I have seen it in thick bamboo jungles at the bottom of the Coonoor pass, in thick hedges and trees in the Carnatic; and in bushy jungle in the Deccan. It wanders about from tree to tree, or works its way through the thick hedges, and feeds on various large insects, such as grasshoppers, mantides and the like; also on caterpillars and other insects. It makes its way with great adroitness through the thick prickly hedges and bushes it delights to frequent.

230.—*X. Sirkee.*—*Eudynamys sirkee*, Gray and Hardwicke's Illustrations of Ind. Zoology.—*Red-billed Cuckoo.*

I have seen this bird in bushy ground on the top of the Neilgherries, but in no other locality till I lately met with it in a hilly and low jungly district, near Jaulnah. It has the same wandering habits, and same kind of food as the last species.

Irides reddish brown; bill cherry red, yellowish at tip; feet plumbeous. Length 16 to 17 inches; wing 6¼; tail 9½; tarsis 1½; bill to

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* This bird is said to be excellent eating.

front 1; at gape 1$\frac{3}{16}$ths; feathers of head and neck with the sh
the feathers black, glistening and bristly.

GENUS CENTROPUS, Ill.—*Lark-heeled Cuckoo.*

231.—*C. Pyrrhopterus.*—*C. Philippensis,* Cuv.—*Corydonix py*
terus, Vieillot.—*Cen. bubulus,* Horsf.—*Mahooka,* H.— *Crow Ph*
of Europeans of India.

The *Crow Pheasant* is a common and universally spread bir
quenting wooded and cultivated grounds, in all parts, and found
the more open spaces of thick jungles. It is often seen in thick h
also in woody nullahs, and in low bushy tracts. It feeds on the g
chiefly, walking and running with great facility, and picking up v
large insects, centipedes, lizards, and even scorpions and small s
It may often be seen walking along the bank of a dry tank, a b
a paddy-field, and being a remarkably slow and stupid bird, and o
flight, it is occasionally run down, or even caught by the hand, i
ficiently open ground. A good shikra will also easily strike it

The *Mahooka* has a deep sonorous call, something like '
whoot, whoot,' which is often heard in a thick bush or hedge, whil
bird itself remains unseen.

Irides crimson red; bill and legs blackish. Length 19 to 20 in
of which the tail is 10 to 11; wing 7$\frac{1}{4}$; tarsus 2 inches; bill to
1$\frac{3}{16}$ths; at gape 1$\frac{6}{16}$ths.

TRIBE TENUIROSTRES.

FAMILY CINNYRIDÆ.—*Sun birds.—honey eaters.*

GENUS CINNYRIS, Cuv.—*Shukur-hor*[illegible] H. i. e. *Sugar-sucker*

232.—*C. Mahrattensis.*—*Certh. Mahrattensis,* Shaw.—*Cinnyris*
talis, Frankl.—*C. cyanœus,* Vieill.—*Certhia Asiatica,* Lath.—*C. c*
ceria, Auct., Young male.—*Purple honey sucker.*

This appears to be the most generally spread of all the *Cinnyr*
and is the only one I have met with in the bare table land. In
Carnatic it is less numerous, I think, than the two next species.

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* Called *Humming birds* by Europeans in India.

I have lately (February) seen the nest of this pretty little bird close to a house in Jaulnah. It was commenced on a thick spider's web, by attaching to it various fragments of paper, cloth, straw, grass and other substances, till it had secured a firm hold of the twig to which the web adhered, and the nest suspended on this was then completed by adding other fragments of the same materials.

The hole is at one side, near the top, and has a slight projecting roof or awning over it. The female laid 2 eggs, of a greenish gray tinge, spotted with dusky. The first nest it made was accidentally destroyed after two eggs had been laid, and the couple immediately commenced building another, in a small tree at the other side of the door, and, as in the first instance, commenced their operations on a fragment of spider's web. They reared two young ones from this nest.

The *Purple Honey-Sucker* has a very feeble, but sweet, chirping note. It feeds like others of the genus, partly on the honey extracted from flowers, and partly on minute insects, flies, cicadariæ, &c. It occasionally hovers on the wing before a flower, while extracting the honey, but generally hops or flies rather among the smaller twigs. Occasionally I have seen it snap at an insect in the air. Whilst feeding it frequently opens and closes its wings. The *C. currucaria* is certainly the young male of this bird, the outline and structure are the same, and in Jaulnah it is of frequent occurrence, no other species of *Cinnyris* but the *purpuratus* being found here: besides I have specimens in which the change to the adult plumage is nearly completed. I shall add a very brief description to show its difference from the next species.

Plumage above, of a glossy steel blue; beneath glossy purple; quills and tail black; plume of orange and yellow feather under the wing; bill and legs black. Length 4½ inches; wing $2\frac{5}{10}$ths; tail 1½; tarsus $\frac{6}{10}$ths; bill straight to front $\frac{7}{10}$ths.

Female, above greenish brown grey; beneath pale yellow; darkest on the throat; tail black; quills dusky.

I have seen this bird on the very top of the Neilgherries, which shews what a great degree of cold some of this tropical genus will suffer without inconvenience.

233.—*C. polita.*—*Certh. polita,* Lath.—Ois. Dor. pl., 11—*Certh. falcata,* Lath. ?—*Certh. purpurata,* Lath. ?—*Glossy green Honey-sucker.*

I have seen this very handsome bird in the Carnatic and west coast, where it is tolerably common, frequenting both gardens and jungles. Food and habits of the last.

Descr.—Above, glossy green; wings and tail dull black; throat a breast rich purple hue. A narrow bright maroon red collar interve between the rich purple of the breast and the dull blackish brown the belly and vent; a tuft of orange and yellow feathers under the wi as in the last; bill and legs black. Length 5½ inches; of wing 2$\frac{2}{10}$t tail 1$\frac{6}{10}$ths; tarsus $\frac{6}{10}$ths; bill straight to front one inch. Fem above light greenish brown, quills darker; tail black; beneath p yellow: only differs from the female of the last in the darker tint of plumage above.

The male, though sometimes confounded with the last species, dif most conspicuously in the much longer and more arched bill, and green play of colours in the upper plumage.

234.—*C. Sola*, Vieill. Ency. Meth. and Lesson.—*Certh. Zeylon* Lath.—*C. lepida*, Sykes' Cat.? not of other authors.—*Amethyst rum Honey sucker.*

This species appears to be more abundant in the Carnatic than in other part of the peninsula. In that district it is very common, an be seen in almost every garden, flitting about from flower to flower, brilliant hues every now and then displayed to the eye as it catches t reflection by the sun.

I presume that this is the *C. lepida* of Sykes' Catalogue, as that is allied species, but the descriptions I have access to of that bird not agree with this one, and moreover in Lesson's Traité the *C. lepi* is also mentioned as well as this species, and said to have been receiv from Amboyna. Nevertheless it may also be found in the west of Indi Mr. Elliot says of this species "builds a hanging nest with an entran near the top, opening downwards." I add a brief description: Male, he and angle of the wings glossy green; throat, neck, rump and upp tail coverts ameythystine; back and coverts, with narrow pectoral maroon red; beneath yellow, wings brown, quills edged with ci namon; tail black, bill and legs do. Female, olive green above, neath yellow, chin and throat white, wings and tail as in male. Leng 4½; wing 2$\frac{3}{10}$ths; bill straight to point $\frac{5\frac{1}{2}}{10}$ths.

235.—*C. minima*, Sykes.—*Smallest Honey Sucker.*

This lovely plumaged little species I have only found but rarely high forest jungle in Malabar. It is very much allied to the last colouring, but differs, besides its smaller size, in the tint of the on the back, which is much richer in this one; there is no green on shoulders, the green of the head also is purer; and the quills are dged with cinnamon. Length $3\frac{3}{4}$; wing 1 $\frac{2}{10}$ths; bill straight to front $\frac{4}{10}$ths;

236.—*C. Vigersii*, Sykes.

I have not been lucky enough as yet to fall in with this splendid species of *Cinnyris*.

GENUS DICÆUM, Cuv.

237.—*D. concolor.*—New species?

Descr.—Above, brownish olive; beneath greenish white; wing and tail brown. Irides brown; bill and legs brownish cenereous. Length 4 $\frac{2}{10}$ths; wing 2$\frac{1}{10}$ths; tail 1 $\frac{1}{10}$th; tarsus $\frac{1}{2}$ inch; bill straight to gape $\frac{1}{2}$ inch; to front $\frac{4}{10}$ths. Sexes alike.

This, if a true species of *Dicæum*, differs from its congeners in the plain and sober colours of its plumage. I have found it in the forests of Malabar, and also on the summit of the Neilgherries. It frequents the highest branches of lofty trees, hopping actively about the small twigs and flower branches, and feeding on various minute insects.

SUB FAMILY PROMEROPIDÆ.

GENUS UPUPA, L.—*Hoopoe.*

238.—*U. minor.*—*Hood-hood*, H., from its call.—*Hoopoe.*

The Indian *Hoopoe* is a tolerably common bird in every part of the peninsula of India; frequenting woody places, groves, single trees, hedges, and about old walls and other buildings; and to be seen in almost every garden. It feeds entirely on the ground, walking along with ease, and picking up various insects as it moves along.

The *Hood-hood* (a name which expresses its call much better than our English term) breeds, I am informed by shikarees, in the hot weather in holes of old walls and other buildings.

TRIBE FISSIROSTRES.

FAMILY MEROPIDÆ,

GENUS MEROPS, L.—*Hurrial*, H.

239.—*M. Indicus.*—*Hurrial* and *Putringa*, H.—*Common Indian Be eater*, often called by Europeans *Green flycatcher.*

This well known and common bird is spread in numbers over all India. It generally hunts like the true *flycatcher* from a fixed station, which is either on the top or upper branch of a high tree, or on the branch of a shrub or hedge, a bare pole, stalk of grain or grass, or some old building. Here it sits looking eagerly around, and on spying an insect, which it can do a long way off, flies off and captures it on the wing, with a distinct snap of its bill, and then returns to its perch, generally sailing slowly with outspread wings, the copper burnishing of its head and wings shining conspicuously in the sun beams. Sometimes it hunts alone, at other times in small parties, seated near each other; frequently it captures one or two insects before it returns to its perch; and in the morning and evening considerable numbers are often seen, sometimes in company with *swallows*, hawking actively about, and apparently catching many insects. The *bee-eater* also often changes its perch, taking up a fresh one at some distance. It has a peculiar loud, yet rather pleasant whistling note, which it often repeats in the mornings and evenings when gathered together. In the bare table land, the *Hurrial* generally retires to some secluded and jungly districts for the purpose of breeding, which it is said to do in holes in ravines. It sometimes picks an insect off the ground or off a flower or branch.

I have often seen this bird collect towards sunset in small parties on a road, and roll themselves about in the sand and dust, evidently with great pleasure.

Length to end of lateral tail feather 7½; of wing 3 $\frac{7}{10}$ths; tail 2 $\frac{8}{10}$ths; two central tail feathers beyond 2¼; bill to front 1 $\frac{8}{10}$ths.

240.—*M. Philippinus*, Auct. P. E. *57.*—*Blue-tailed bee-eater.*

This bird, by no means common any where, is rarely met with in the Carnatic or table land, and only, I think, in the cold weather. It prefers a well wooded country, and I have seen it in Goomsoor in open parts of the jungle, and in the west coast occasionally in similar situations. It is almost always found in small parties seated on the tops of high trees, frequently among wet paddy-fields, and in general perhaps, making a much longer circuit than the last one, capturing several insects before returning to its perch. I have on one or two occasions seen it perched on a low palisade overhanging some water, and every now and then picking an insect off the surface of the water. I once saw an immense flock of them at Caroor, in the Carnatic (Coimbatoor district) and in the beginning of March. There were many thousands of them perched on the lofty trees lining the road there, which occasionally sallied forth for half an hour or so, making a great circuit before returning. These birds were most probably what had been spread over great part of that country, now collected to migrate into a more wooded region, during the approaching hot season when insect life is scarce.

Like the last, this has a loud and pleasing sort of whistle, more full and mellow than that of its more common congener.

Length to end of lateral tail feathers 9½ inches; two central feathers beyond 2 inches; of wing 5¼; tail 3¾; bill to front 1½.

241.—*M. quinticoler*, Vieillot, Encyl. Method. p. 393.—*Chestnut-headed bee-eater.*

I have only seen this bird on two occasions, once at the foot of the Coonoor pass in dense jungle, and again in an open forest on the Malabar Coast. It pursued insects from a fixed perch, returning after having captured one—was generally seated on a low bough, solitary, or two or three together. Irides fine red.

Length 9 inches; wing 4 $\frac{3}{10}$ths; tail 3¼; bill to front 1 $\frac{3}{10}$ths.

There is no *elongation* of the central tail feathers.

242.—*M.? cyano-gularis.*—New species?.—*Nyctiornis?.*—*Blue-throated bee-eater.*

Descr.—A broad blue stripe extends from the base of the lower mandible down the throat and breast; upper part of the body, the head and tail, green, with a bluish tinge; belly of a buff colour, with dashes of green; eye, bright scarlet; bill and feet brownish black.

Length 14 inches; wing 5½; tail 6; tarsus ½ inch; bill 1¾.

I have two or three times observed this fine species of *bee-eater* at the foot of the Coonoor pass of the Neilgherries, in dense and lofty jungle. One time it was alone, the other times I observed it in pairs, perching on the tops of the highest trees, and flying before you from tree to tree. I was not fortunate enough to obtain a specimen, owing to their extreme wariness, but was kindly allowed to inspect and examine a specimen procured by M. Delessert. I suspect from the shortness of its wing that it is a *Nyctiornis* of Swainson.

GENUS CORACIAS, L.—*Roller.*

243.—*C. Indica*, L.—*C. Bengalensis*, Steph.—*Cor. nævia*, Vieill. and Less, Edwards pl. 326.—*Subzuk* and *Neelkond*, H., both words having reference to its colours.—*Tās*, Mahr. from its call.—*Indian Roller*, generally called *Jay* by Europeans.

The Indian *Roller* is of universal distribution throughout the country as well in jungles as in the open country, there being few groves o trees near a village that do not harbour some. It generally takes its perch on the top or outermost branch of some lofty tree, and on spying an insect on the ground, which it can do at a very great distance, 40 or 50 yards and more, it flies direct to the spot, and generally seizes it on the ground, and then returns to the same tree and perch. A favourite perch of the *Roller* is a bowrie pole, or some bare leafless tree, by which it can command a larger range of view. It occasionally seats itself on a low bush, or even on the ground. I have on several occasions seen one pursue an insect in the air for some distance. It flies in general with a slow but continued flapping of its wings, but it has the habit of occasionally making sudden darts in the air in all directions. It has a harsh grating cry which it often utters on being disturbed. Its food is chiefly large insects, such as grasshoppers and their larvæ, caterpillars, mole-crickets, and even mice, which according to the shikarees are a certain bait for the *Subzuk*. I have frequently seen it caught by baiting with mole-crickets *(Gryllotalpæ)* placed at a great distance from its perch.

Irides dark red brown; bill brown; legs orange. Length 13½; wing 7½; tail 5; tarsus 1; bill at gape 1 $\frac{7}{10}$ths.

Towards the north of the Deccan at Jaulnah, shikarees inform me that another kind of *Subzuk*, which they call the '*Pindareea Neelkund*,' makes its appearance for a short time during the commencement of the cold weather. Is this the *Eurystomus Orientalis*?

FAMILY HALCYONIDÆ.—*King-fishers.*

GENUS HALCYON.—SW.

SUB-GENUS HALCYON.—SW.

244.—*H. Smyrnensis.*—*Alc. Smyrnensis,* Auct.—*Kilkila,* H.—*White breasted King-fisher.*

This is the most common and generally spread of the Indian *King-fishers,* frequenting not only the banks of rivers and brooks, tanks, wells, and wet paddy-fields, but also dry cultivated ground, groves, old walls, and many other similar situations. It preys upon small fish, frogs, tadpoles and various water insects—also on small lizards, grasshoppers and various other large insects.

It has a very loud harsh rattling scream, generally uttered during flight. Is said to breed like the other *King-fishers* in holes on the banks of rivers. It is readily taken with a bait of a mole-cricket. Irides light brown; bill and legs red.

Length 11½ inches; wing 4 $\frac{8}{10}$ths; tail 3¼; bill to front 2 $\frac{3}{10}$ths; at gape 2 $\frac{8}{10}$ths.

245.—*H. capensis.*—*Alc. capensis,* Auct.—*Malah-Poymah,* Mal. i. e. *Jungle King-fisher.*—*Large Jungle King-fisher.*

This large *King-fisher* is found wherever there is lofty jungle. I have seen it in Goomsoor, Malabar, and Travancore; also once lately in a well wooded brook in the northern part of the table land. It frequents brooks, rivers, and tanks, and, in the instances I have observed, always feeds on fish. Irides light brown; bill deep lake red; feet vermilion red.

Length 14 to 16 inches; wing 5 $\frac{3}{10}$ths; tail 4; bill to front 3 inches to 3 $\frac{1}{10}$; at gape 3 $\frac{8}{10}$ths to 4 inches.

SUB-GENUS CEYX.

246.—*C. microsorna,* Burton, Proc. Zool. Soc. 1837?.—*C. purpureus,* Less.?—*C. tridactyla,* Sykes' Catalogue.—*Three-toed King-fisher.*

Not having obtained this little *King-fisher,* I have given the above names as synonymes with doubt. I have once or twice only observed this rare bird frequenting a tank in the northern part of the Deccan.

GENUS ALCEDO.

SUB-GENUS ALCEDO.

247.—*A. Bengalensis,* Gmel., Edw. pl. 11.—*Chota Kilkila,* H.

This species, so nearly allied to the European one, is common over all the peninsula, frequenting chiefly brooks and rivers, and feeding on small fish, and various aquatic insects. I possess a variety in which there is a good deal of white on the head, back of neck and back. In this one too the bill is entirely black. I may also remark that in some the shade of the plumage is bluish green, in others of a pure blue. Irides dark brown; bill black above; lower mandible orange; feet orange.

Length 7 inches; bill to front 1 $\frac{4}{10}$ths.

Sub-Genus ISPIDA, Sw.

248.—*I. rudis.*—*Al. rudis,* Auct.—*Koreyala Kilkila,* H.—*Black* and *white King-fisher.*

Common over all India, frequenting brooks, rivers and tanks. Unlike the other *King-fishers* which watch for their prey from a fixed station, and then dart down obliquely on it, the *spotted King-fisher* searches for its prey on the wing, hovering over a piece of water like some of the *Terns,* and then darting down perpendicularly on it. Irides hazel brown; bill and legs black.

Length 11 to 11½ inches; wing 5½; tail 2¼; bill to front 2 $\frac{3}{10}$ths; at gape 2 $\frac{8}{10}$ths.

Family TROGONIDÆ.

Genus TROGON, L.

Sub-Genus HARPACTES, Sw.

249.—*H. Malabaricus,* Gould's Monograph?—*Trog. fasciatus,* Lath. —*Tro. Kasumba,* Raffles.—*Tr. Condea,* Temm. P. C.—*Koofnee Chooree,* H. of some shikarees.—*Kurna,* Mahr.—*Kakerne hukki,* Can.

This very richly plumaged *Trogon* is of rare occurrence in Southern India, and I have only found it in the densest portions of lofty jungle in Malabar and the Wynaad. It is, however, enumerated in Mr. Elliot's Catalogue. It is generally seen seated motionless on the branch of a tree, occasionally flying off to capture an insect, and sometimes, though rarely, returning to the same perch, generally taking up a new position, and wandering much about from tree to tree. I almost always observed it solitary—occasionally in pairs, and on one occasion four or five were seen together. In the stomach I have always found fragments of large coleopterous insects. The Hindoostanee name *Koofnee Chooree,* is given (says Mr. Elliot) "from its sitting with its head sunk in the shoulders, as if it had no neck, or as if dressed in a faqueer's '*koofnee.*'" Irides deep brown; bill and naked skin of fine deep cobalt blue; legs light blue.

Length 12 inches; of which the tail is above 6; bill straight to gape 1 inch.

The female differs from the male in wanting the black head and neck, which are of a light greenish brown. The belly is ochreous instead of red, and the wing coverts are light ochreous brown, finely streaked with black, instead of black and white.

FAMILY CAPRIMULGIDÆ.—*Night-jars.*

GENUS CAPRIMULGUS, L.

SUB-GENUS CAPRIMULGUS, Sw.

Chippuk, H. vulgo *Dubchkooree* or *Dubhuk*—also *Undhe-chooree*, names given from its habit of squatting.

The species of this genus so much resemble one another that it is almost impossible to make them out from description alone, and I feel uncertain whether I am referring my specimens to their proper places. Four species have been described as inhabitants of the continent of India. I also possess what I consider four distinct species, and shall in the proper place describe the most essential points of difference between these four Indian *Night-hawks*, without reference to any others of the genus.

250.—*C. monticolus*, *Frankl.* Cat.

The only specimen of this species which I procured was immediately below the Ajunteh ghaut, in the low land of Candeish, so that the name of '*monticolus*' appears inappropriate to its habits in this part of the country, whatever they may be in Bengal. It differs remarkably from the other Indian *Caprimulgi* by the two external feathers of the tail being entirely white, tipped with mottled brown. The white marks in the four external quill feathers also are much larger than in any of the others.

Length of my specimen 10 inches; of wing which reaches to the end of the tail 8; tail 4½; tarsus $\frac{7}{10}$ths.

251.—*C. Indicus*, Lath. ?—New species ?—*Neilgherry night-jar.*

I have temporarily placed this bird under the old name of *C. Indicus* of Latham, chiefly from the fact of its being feathered to the toes, as the *C. Indicus* is represented in the figure in Gray and Hardwicke's Illustrations of Indian Zoology. It differs, however, from the description and figure of that bird in having much less rufous tint, and being of a darker shade altogether, both above and beneath. This may depend however, partly on age. I shall here give a brief description—plumage generally of a light cinereous, very much mottled with black and dusky, and in parts tinged with light fawn and cream colour; ears black, edged with light rufous; line below the ears extending along the gape, and throat spot, white. White marks on the four quills small. All the tail feathers, except the two centre ones, tipped with white, with a dusky margin. Wing not reaching to the end of tail which is long.

Length 11½ inches; wing 7½; tail $5\frac{6}{10}$ths; tarsus, feathered to the toes, not quite $\frac{6}{10}$ths.

Besides the differences above mentioned, the inner surface of the quills are represented in Hardwicke's drawing as being spotted on both sides with rufous white. In my specimen the external quill alone is spotted on the outer web only, and with very minute whitish marks.

I have only seen this *night-jar* on the summit of the Neilgherries, frequenting the stony hills, and during the day taking refuge in the woods.

252.—*C. Asiaticus*, Lath. ?—*Small night-jar.*

The species which I shall for the present consider as the *C. Asiaticus* of Latham, is the smallest and most generally spread of all the Indian *night-jars*. I have found it in the Carnatic, west coast and Northern Circars, but not yet seen it on the table land, where, however, it was obtained by Col. Sykes. My specimens differ from the figure in Hardwicke's Illustrations, in wanting the black ear and sides of throat, but appears to resemble it much in other respects.

Length 8¾; of wing 5½; tail 4¼; tarsus $\frac{7}{10}$ths.

253.—*C. Mahrattensis*, Sykes?—New Species?—*C. Asiaticus.*—var.?

This night-jar, which for the present I place under Col. Sykes' new species with doubt, very much resembles the last in the general distribution of the colours, but it is of a lighter tint throughout, and the rufous of the last is replaced in parts by a lighter or cream coloured hue. It much resembles the drawing of *C. Asiaticus* in Gray and Hardwicke, with which I suspect it is identical. It differs from Col. Sykes' description of his *Mahrattensis*, in having a sub-rufous or fawn coloured collar on the nape of the neck, and in the size and length of the tail, as given by Sykes, whose species, if these are permanent differences, is probably a different, though nearly allied bird, as it is stated by Sykes to have the two external tail feathers, only, tipped with white, like these two last ones, which after all I suspect may be perhaps but mere varieties, this one differing chiefly in size, and the lightness of its plumage. In this case, however, there will still remain a fourth species, viz. Col. Sykes' '*Mahrattensis.*'

My specimens were found in the northern part of table land near Jaulnah. Length rather more than 9½; wing 6; tail 4½; tarsus nearly $\frac{8}{10}$ths.

All the species of the *night hawk* I observed have the habit, when roused in the day time, of flying a short distance, and then alighting on the ground and squatting close, not moving from the spot where they have first alighted. The note of the common one (No. 252), as well as of the Neilgherry species, both resemble the sound of a stone scudding over ice, or, as is well represented by Mr. Elliot, sound like the word *tyook, tyook, tyook.* Mr. Elliot in his notes states that he once found the eggs of the common species (two in number) placed on the ground without any nest. They were pink, spotted with brown.

FAMILY HIRUNDINIDÆ.—*Swallows.*

GENUS CYPSELUS, L.

SUB-GENUS CYPSELUS, SW.

254.—*C. Alpinus*, Temm.—*H. Melba*, Auct.—*Large mountain Swift.*

As far as I can judge from descriptions, my bird is the same as the European one. I first observed it on the road between Madura and Palamcottah, when an innumerable flock passed over camp from the range of eastern ghauts, travelling towards the east coast. It was almost mid-day in the month of August. They kept a steady easterly direction. I afterwards saw in Travancore single birds, flying about at an immense height with great rapidity. I also saw them on the top of the Neilgherries, towards the edges of the hills, and also at Madura, flying in small parties every evening, just before sun-set, towards the east coast, apparently from the hills in the neighbourhood, as I did not see them during the day time. Its flight is amazingly rapid. Length 9 inches; wings beyond 2 inches; from flexure 8½; tail 3; bill straight to gape 1 inch.

255.—*C. affinis*, Hardwicke, Gray and Hardw. Ill. Ind. Zool.—*Ababeel*, H.—*White-rumped Swift.*

This species, though of general distribution throughout the peninsula, yet at the same time is so partially distributed as to have caused

Col. Sykes to say in his Catalogue "so rare in the Deccan that I hav only obtained 2 specimens." It is found in all districts of India, bu in these is often confined to a small tract in the neighbourhood of som few large pagodas, large old choultries, and other similar buildings In the Carnatic it is common at Madras, at the rocky fort of Trichinopoly, and very numerous at the large pagodas of Madura, among which their nests are thickly crowded. On the west coast I saw it on severa occasions, chiefly among rocky hills, but only observed it twice or thrice throughout the whole length of the table land from the Tapoo pass to Jaulnah, and then but few in number. At this latter place, however, it is very common, breeding in some old choultries and othe buildings. It seldom, I think, takes a very long range from its breeding places. It builds its nest in company always, often thickly crowded together, placing them in corners and crevices of old buildings, and forming them of clay, profusely mixed with straw, grass, feathers and other soft substances, of which they appear externally to be entirely composed. During the night they roost in their nests, four or five often occupying the same one, as I observed in the celebrated choultry at Ajunteh.

The eye of this *Swift* is deeply seated, the eyebrow overarches it, and a ridge continuous with the eyebrow extends along the gape.

Length about 5½; wing beyond 1½; from flexure 5; tail 1 $\frac{6}{10}$ths.

256.—*C. palmarum*, Hardw., Gray and Hardw. Ill. I. Zool.—*Balassian Swift*, Lath.

This little species is common in all the districts of India, except on the bare table land, where it is rare. As its name implies, it frequents groves of palms, especially the palmyra (*Borassus flabelliformis*), and does not in general fly to any distance from them. It is very abundan in the Carnatic. According to Hardwicke it builds its nest on the lea of the palm.

Length 5½; tail 2½; wing 4¼. This bird is said in some works to b nocturnal. I need hardly add that such is not the case.

Genus MACROPTERYX, Sw.—*Swallow-tailed Swift.*

257.—*M. longipennis*.—*C. longipennis*, Temm. P. C. pl. 83.—*Hir. Klecho*, Horsf.—*Crested long-winged Swift.*

This very elegant *Swift* is only found in the South of India, in high forest jungle in the neighbourhood of hills. I have seen it in Goomsoor, at the foot of the Neilgherry hills, and in various parts of the jungle of the western coast. It frequently perches on bare and leafless trees. While on the wing it has a somewhat loud parrot-like cry, very different from that of the other species.

Irides deep brown; bill black; legs bluish black; soles of feet reddish white. Length about 10 inches; wings 6; tail 5; 1¼ inch longer than the wings.

The female differs from the male in having black ears instead of rufous, and in having a white streak along the gape. The elegant frontal crest of this species is frequently raised when the bird is sitting.

GENUS HIRUNDO, L.—*Swallow.*

258.—*H. Jewan*, Sykes.—*H. Javanica*, Lath.?—*Common Swallow.*

This is perhaps the most generally spread, and abundant of the Indian *Swallows*, being found in all parts of the country, frequenting both the neighbourhood of water, and open plains and gardens. It appears to differ but very slightly from the European swallow. I do not know if it breeds in this country, but think not; and it certainly disappears from some places during the hot season and monsoon. If it does not breed in the North of India, it probably spreads over the north of the Asiatic continent.

Length 7½; wing 4¾; tail beyond 1 $\frac{4}{10}$ths; from base 4.

259.—*H. Erythropygia*, Sykes.—*Red-rumped Swallow.*

This *Swallow* in general, prefers the proximity of jungles. I saw it in Goomsoor, in the jungles round the Neilgherries (and also on the summit of the hills), in various other parts of the west coast, and in the Carnatic, at the Tapoor pass. In the northern part of the table land, however, I have seen it occasionally in the cold weather only, both in the neighbourhood of water and on dry open plains. It often is seen in the jungles it frequents, seated in great numbers on a tree. Mr. Elliot says of this species " flies after insects, and when its mouth is full sits on a tree to devour them." This bird varies a good deal in size. My specimens vary from 6 to 7½ inches long, of one of the latter the wing is 4½; and tail nearly 4.

260.—*H. filifera*, Stephens.—*H. filicaudata*, Frankl. Cat.—*Leishra*, H.—*Wire-tailed Swallow.*

This, by far the most elegant of its genus, is only found towards the more southern portion of the peninsula, about water. In the more northern parts, however, it is more abundant, and generally spread frequenting not only the neighbourhood of water, but also fields gardens and open plains. It is found in small parties of 4, 6 or more It breeds in holes of old walls and buildings, generally in the neighbourhood of water, also in wells and bowries, forming a small mud nest much open at the top. Its long tail feathers are only observabl at a few yards distance, and in consequence of this, nine-tenths of Europeans here are unaware of its existence. It occasionally perches on trees.

Length to end of true tail 4½ to 4¾; of wings (1½ inch beyond tail) 4 $\frac{6}{10}$ths; tail 1½; long thread-like feathers beyond tail 5 inches; and more even.

261.—*H. concolor*, Sykes.—*Small black Swallow.*

I have never observed this plain coloured *Swallow* in the Carnatic, northern division, or west coast, and only towards the more northern portion of the Deccan. It is by no means numerous here—is solitary, frequents tanks and rivers, and also gardens, fields and villages. It breeds in the caves of houses, in high walls, and other buildings. Length to end of tail 4 $\frac{6}{10}$ths; of wings 4; tail 2.

262.—*H. Unicolor.*—New species.—*Hill Swallow.*

Descr.—Entirely of a glossy cinereous, or mouse brown; darkest on head, wings and tail, and with a tinge of green, and palest beneath.

Length 4¾; of wing 4½; beyond the tail 1 inch; tail 2; slightly forked and with the feathers very broad. The bill of this *Swallow* is much smaller than that of any of the Indian ones, and is also much hooked. It most closely resembles the *Cyp. palmarum* in colour Tarsus $\frac{3½}{10}$th; feet very small.

I have only found this remarkable species on the Coonoor pass of the Neilgherries, and about the edges of the hills. It flies in large flocks and with very great speed.

263.—*H. Sinensis*, Gray and Hard. Ill. I. Zool. ?.—New species ?—*River Martin* of India.

I know not if the little *Martin* I possess, be referable to the spec above named or not, though I think it is probably distinct. I have oc found it on one or two occasions in small parties, frequenting rive and breeding in holes in the river banks, during the month of D cember. I add a brief description.

Above of a light brown colour, lightest on the rump; wings and tail dark brown; chin, throat and breast, pale brown; belly, vent and under tail coverts, white.

Length $4\frac{1}{4}$ inches; wing $3\frac{1}{4}$; tail $1\frac{6}{10}$ths; wings reach $\frac{1}{2}$ an inch beyond tail, which is very slightly forked; tarsus $\frac{4}{10}$ths; bill to front $\frac{2}{10}$ths.

264.—*H. riparia*, L?.—New species?

This *Swallow* I venture to place (though with hesitation) under the European species, as I see it is enumerated in Franklin's Catalogue. It differs from the last named species, chiefly in its larger size, lighter coloured wings and tail, whitish throat, and in the rump being of the same shade of colour as the back.

Length $4\frac{3}{4}$; wing 4; tail 2; sligtly forked; tarsus hardly $\frac{4}{10}$ths; feathered on the back down to the hind toe.

I have hitherto only seen this species on one or two occasions in the neighbourhood of Jaulnah. It was on both occasions single, but flying in company with other swallows (*H. Jewan* and *H. filifera*) in the close neighbourhood of water.

II.—*Account of a Carboniferous Stratum at Baypoor near Calicut, Malabar Coast.—By Lieut.* T. J. Newbold, *23d Light Infanty.*

In consequence of having observed some carbonaceous bits of clay in the bed of the river at Baypoor, a sea port town about 6 miles south from Calicut on the Malabar coast, in lat. north 10° 11′, and long. east 75° 53′, I took a canoe and proceeded up the river in order to examine the section of the strata, its northern bank afforded. It presented steep cliffs, varying from 20 to 40 feet in height, which, near the mouth of the river immediately below the traveller's bungalow, consisted of a gritty laterite; that further up the river passes into a horizontally stratified loose grit or sandstone; this often becomes compact and variegated with red and yellow bands. Beds of an ochreous yellow earth tend to loosen its structure, near which it assumes a friable, earthy, character.

Not far from the bungalow, underlying these beds at the foot of the cliffs, near the river bed, and washed by the tide at high water is a seam or stratum of carbonaceous shale, passing into a black clay from the saline moisture to which it is continually exposed, and imbedding carbonized branches, leaves and trunks of trees. This bed varies from a few inches to five feet in thickness, dipping 4° towards the north-east, and can be traced about half a mile in an easterly direction up the northern bank of the river. It is intersected by deep, nearly vertical fissures, which are crossed in various directions by others more superficial. Its structure is obscurely laminar, and the more earthy portions of it glitter with minute micaceous particles. Other portions seem to consist wholly of carbonized woody matter, and have a tough elastic feel under the hammer. Its colour varies from a greenish black to a jet black. In two situations it imbedded numerous small shells, some of which had been reduced to fragments, and differing from the shells at present found in the river. The identification of these shells would probably afford an insight into the age of the laterite hitherto a desideratum in Indian geology. Should we feel disposed to refer the age of this carbonaceous deposit to that of the coal measures of Europe, the laterite here might be classed with the new red sandstone. The black shale and clay is highly impregnated with sulphate of alumina, and is somewhat analogous to the aluminiferous shale of the coal measures; and, like it, as before remarked, contains micaceous spangles disseminated. The surface and sides of the fissures are frequently coated with a yellowish efflorescence consisting chiefly of sulphur, iron and alumina: the two former of which appear to be in process of combination into the pyrites, usually seen in coal, rather than the result of decomposition from pyrites. The whole has a distinctly sulphureous odour. The carbonized branches, leaves and trunks of trees lay in a horizontal position in the black shale; from which, in consequence of their weathering less, they often projected where washed by the tide. The external longitudinal fibres and annular concentric delineations of some exogenous trunks were perfectly distinct. Some fragments were brown, heavy, tough, and woody; others brittle, with a brilliant fracture resembling a jet, light and bituminous; on some the thin bark was perfectly distinct, and exhibited in a beautiful manner the different stages of the carbonization of wood. Many fragments were penetrated with water, holding iron in solution, which had left on the surface a glittering reddish brown enduit.

The whole appearance of these strata, their situation and the horizontal position of the trees, leaves, and plants embedded in them, fully bear out the theory of the formation of our coal-fields and wealdens (viz. that they are the successive deposits of drifted trees, plants, clay and sand on the bed of a river or estuary) against the objections of a late writer, Mr. Beaumont, who is of opinion that the coal vegetations grow and accumulate where they are found, on the surfaces of small islands, which have been subsequently submerged by the ocean. However, there appears to me to be no objection to the existence of both theories, if made applicable to the different conditions under which the coal-fields are found. The combination of iron, sulphur, and water in the deposits at Baypoor, has evidently afforded the principal chemical conditions for ligneous carbonization.

The following are the measurements of a section of the cliff and carboniferous stratum of Baypoor in a descending order:—

1st. 4 feet of sandy alluvial soil.

2nd. 10 feet of loose sandstone with beds of ochreous earth.

3rd. 20 feet of gritty sandstone, passing into gritty laterite, and variegated in its lower portions with red and yellow bands.

4th. carboniferous stratum varying from a few inches to five feet in thickness.

5th. level of the river.

The haste with which I was travelling prevented my examining the specimens as minutely as I could have wished; but the following results obtained by the blow-pipe will not be uninteresting. The leaves and stems of plants burnt slowly, with a faint flame of a bluish red tint, emitting a smell like that of coal, and leaving a reddish and whitish ash, the white appearing near the edges. This ash being submitted to the reducing flame, fused partially on its edges, exhibiting points of a greenish enamel, and others of a dark slag, attracted by the magnet. The black clay and shale, on the oxidizing flame, decrepitates, turns grey, and emits an odour of coal more or less distinct and sulphureous according to the predominance of earthy or carbonaceous matter in the specimen selected for examination. The change of colour exhibits the delicate fibres of plants in its structure, that were invisible previous to the application of heat. In the reducing flame it fuses into a light greenish grey enamel, or dark slag attracted by the magnet. The fibrous, heavy, carbonized wood burnt with scarcely any flame at all into a reddish cinder, giving out an odour, like that of burning coal. This finally fused, with slight gaseous extrication, into a black slag, powerfully attracted by the magnet. The yellowish sulphureous cauliflower-like efflorescence, before mentioned as encrusting the surface of the black shale, emitted distinct fumes of sulphur, and melted in the oxidizing flame, giving out numerous gaseous bubbles, into a dark cinnabar-red globule; which, on being exposed to strong

heat, was converted, with considerable diminution of bulk, into a bl
magnetic slag.*

I observed traces of a similar carbonaceous bed in the banks of
Tirtalla river in south Malabar, between Paulghaut and Calicut;
Colonel Cullen informed me, that he had discovered, so far back
1832, a carboniferous seam, four or five feet thick in its broadest p
in a perpendicular cliff of laterite at Vorkully, a little south
Quilon. The cliff he described to me as about eighty feet high, faci
the sea, and resting immediately on garnetiferous gneiss. The bla
aluminous shale and clay imbedding the carbonized wood was satu
ted with the moisture which percolated through the spongy substa
of the superincumbent laterite. The specimens given me by Colo
Cullen, and for which I feel much indebted, assimilated in every resp
those of Baypoor; except that the proportion of sulphureous mat
was less in the former. Colonel Cullen also informed me that he
served some carbonaceous looking strata near Cannanore. It wou
seem therefore that their extent on the Malabar coast is considerab
and it is possible that they may be a continuation of one great depos
or basin, the southern edge of which may be the stratum observed ne
Quilon, which Colonel Cullen states to be inclined at a considerab
angle with the horizon. A few well conducted boring experime
made in favourable situations within this area, which is almost entire
occupied by the laterite, would serve to elucidate this point, and p
haps bring to light a more perfectly formed seam of coal. If so,
proximity to the coast and Bombay, and facilities of water carriag
would give it great advantages over the produce of the coal fields
the interior of Bengal.†

Colonel Cullen has accordingly favoured us with the following obs
vations on his discoveries on the Western Coast, referred to in
Newbold's paper.—Editor.

" I have no notes taken at the time, and I can only therefore now st
generally from memory the appearances of these deposits.

" The deposit at Cannanore was examined very superficially. It c
sists exclusively of an aluminous clay or shale of a dark carbonace

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* The carbonized wood with a shining fracture like jet, burnt into a light cinder
considerable flame.

† I have forwarded specimens of the Baypoor stratum for the museum of the Soc
by sea from Cannanore.

colour, and was discovered accidentally, at the base of the laterite cliffs on the sea-shore at Cannanore, in February 1830. The cliffs are about fifty or sixty feet high. Their upper portion consists of the usual indurated dark red ferruginous clay; but, as the depth from the surface increases, the colours become greatly brighter and more variegated, and the clay soft and sectile and full of moisture; water in several places penetrating through the cliff. The aluminous or carbonaceous stratum is near the base of the cliff, and from the moisture it has a perfectly black appearance. I do not recollect any appearances of fossil vegetable matter—nor was I then aware of the Quilon deposits—and, being unwell, did not repeat my visit.

" The carboniferous deposit in Travancore, was pointed out to me in 1832, when on a visit. It is near the village of Vorkully, about fifteen miles S. of Quilon, and in the cliffs immediately on the sea-shore. The cliffs are here about eighty feet high, quite perpendicular, the upper portion consisting as usual of the indurated dark red laterite; gradually changing, as the depth from the surface increases, into bright and variegated colours, as at Cannanore. The carboniferous bed here is very conspicuous. It lies in an inclined position; the upper part of the bed about sixty feet from the top of the cliff, and the lower portion within five or six feet of its base, and easily accessible therefore. It was full of moisture, and water streamed from it. Above and below the bed, to the very base of the cliff, is composed exclusively of these variegated laterite clays. I do not think that the carboniferous stratum passed below the surface of the beach; if I recollect correctly, it terminated abruptly within five or six feet. It was quite insulated, and of a lenticular form, five or six feet thick at the most. The specimens of fossilized wood, both monocotyledonous and dicotyledonous, and the shale or clays of this stratum, have already been forwarded to the Society. I may add that the laterite in which these carboniferous beds have been discovered, appears to repose, as throughout Malabar, immediately on gneiss, masses of which appear in the sea, close to the cliff at Vorkully, and are to be found also in abundance within a few miles S. of the deposit at Cannanore."—W. C.

III.—*Note on the Geological position of the Laterite in the vicinity of Beder.—By Lieut.* T. J. Newbold, *23d Light Infantry.*

In presenting to the Society an additional number of geological specimens from the Nizam's dominions, the Southern Mahratta Country, and the western ghauts, I have deemed it necessary to offer a few explanatory remarks on the geological *situs* of those collected in the vicinity of Beder. It was partly with the view of ascertaining the relative position of the laterite with regard to other rocks, that I was led to visit this ancient Mahomedan capital.

From the village of Cummumpilly, twenty-six miles E. S. E. from Beder, on the Hyderabad road, by Beder, to the western confines of the Nizam's dominions, the only rocks observed are the overlying trap, associated with amygdaloid, wacké, laterite, and a conglomerate formed from the *débris* of the laterite, with the exception of a narrow zone of grey limestone on the banks of the Bhima. The laterite is first seen resting as a bed, about 100 feet thick, on a trap hill, shaped like a truncated cone, near Sungum, about sixteen miles E. S. E. from Beder. Thence it continues capping the trap elevations with little interruption, forming the surface rock of the extensive table land on which the fortress and city of Beder stand. Here it rises in cliffs from 60 to 200 feet high, the trap appearing at their base, and continues capping most of the higher summits by Calliany to Gulberga; while the trap is seen forming the base of the plain and lower hills, to the bed of the Bhima. From this, across the frontier, the laterite and its conglomerate are occasionally observed in the Southern Mahratta Country, at Ingleswara, and in the vicinity of Bagwari and Belgaum, always overlying the trap on its associated wacké or amygdaloid.

The localities around Beder, where the best sections are afforded, exhibiting the superposition of the laterite on the trap, are some of its deeply sunk wells, and the base of the cliffs to the east, west and north. The rocks near their junction, are more or less blended together, which renders it difficult to draw a line of demarcation between the two. The trap is generally in a soft friable state, and the laterite abounding in lithomargic earth,—conditions, the explánation of which will be attempted elsewhere. The former rock, however, is little altered in one situation where it comes in contact with the laterite, viz. in the section afforded by the well, called the Begum's bourie, which lies a little to the S. E. of the mausoleum of the Mussulman Pir-zadeh, Shimilla Hussaini.

At the base of the cliffs west of Beder, veins of manganese, blended with iron ore, intersect the laterite near its contact with the trap, which appear to have penetrated from below. I am not aware whether the occurrence of similar veins in laterite has been previously noticed by geological observers. They were seen subsequently in the laterite of Ingleswara, and also in the sandstone near its contact with the trap, between Kulladghi and the falls of Gokauk. It is not improbable that the purple colour of the lithomarge, and that of the veins of amethystine quartz in the vicinity of Hyderabad, near which I detected manganese, may be owing to the presence of this mineral.

The soil on the surface of the elevated table land of Beder, is the result of the decay of the subjacent laterite, intersected by belts of black cotton soil. Voysey noted four well defined zones of this soil, running north and south, and lying between "ridges of iron clay," on the road from Beder to Shelapilly.

The laterite, as on the Malabar coast, is quarried at Beder, Calliany, and Belgaum, and extensively used for building. At Calliany shops and houses, now deserted, have been excavated in the solid rock; it is also employed, when ground into a clay with water, as a water-proof cement for the flat roofs of the houses in the last named town. The amygdaloid associated with the trap and laterite imbeds most of the minerals noticed in the great overlying trap formation of the Deccan, viz. calcedony, cornelian, semi and common opal, cacholong, calcspar, agate, jasper, heliotrope, a variety of zeolites, glauconite, olivine and augite.

IV.—*Geological Desiderata.—By* Lieut. T. J. Newbold, 23*d Light Infantry.*

1.—Observations on the direction of mountainous elevation throughout India, with reference to Elie de Beaumont's theory of the determination of the epoch of their *soulevement.*

2.—Connected and extended observations on the dip and direction of the stratified rocks, from the plains to the bases of uplifted abnormal masses. These observations should be continued on every side of the bases, and carried on in connexion with similar observations on the dip and direction of the joints and cleavage of rocks. The petrographical character of the rocks in all cases should be carefully noted. Little attention has hitherto been paid to these important subjects by Indian geologists.

3.—Observations tending to elucidate the causes and conditions of the modifications of structure and morphic changes, remarkable in even continuous, and apparently homogeneous masses of both normal and abnormal rocks; and especially obvious near their line of contact with rocks of a different mineral character.

4.—Similar observations on basaltic dykes, and the rocks they pass through; noting the various amount of disturbance and alteration, with reference to the magnitude of the dyke. It will not escape the attention of observers that the basalt itself has been in some measure reciprocally acted upon by the rocks it penetrates. For instance,—the basalt passing through the clay-slate of the eastern ranges of the Ceded Districts, which is frequently converted into flinty slate or becomes crystalline and hornblendic, acquires a distinctly slaty structure, and so much modified in mineral character as scarcely to be distinguished from the altered clay-slate in its vicinity. In thin veins and near the edges of large dykes the basalt becomes compact; but towards the centre, where more slowly cooled, it is almost invariably of a crystalline, and sometimes of a porphyritic structure. Where basaltic dykes abound a general tendency to crystalline and metallic development will be remarked; as well, perhaps, as an increase in the deposition of saline and calcareous matter,—the sub-carbonate, muriate, and sulphate o soda. Those extensive depositions of nodular, tufaceous, travertine like, and friable carbonate of lime,—the well known *kunkar* of India,—appear to have their origin from springs rising up from nearly vertica fissures in the subjacent rocks, which are invariably more numerous in the vicinity of great basaltic dykes, and have been caused, possibly, by the same disruptive forces that opened a vent to the basaltic matte with which many of the greater cracks are filled. A series of extensive observations incline me to the opinion that this basalt, and not granite as generally thought by Indian geologists, is the lowest rock found in peninsular India, and that its development has a much greater influence over the direction and altitude of mountain chains than the usually supposed granite; which, though frequently observed with the uplifted schists resting on its shoulders, will, where opportunities of examination occur, be found to be merely an intermediate rock between the basalt and the normal rocks it underlies. It must not be forgotten in making comparative observations on the direction of the basaltic dykes and on that of the mountain chain near which they occur, that we are most frequently doing so on branches merely from the main dyke, which diverge from it at various angles with its course, while the main dyke is often concealed from view by the masses of rock it has uplifted. It is in the deep transverse valleys and clifts through ranges, and in low situations near their termination, in wells and other artificial or natural sections, that we are most likely to discover the true direction of the main dyke. To the *soulevement* of some of these branches may be attributed those low ranges of hills, called spurs, that often diverge at right angles from the direction of the principal chain.

5.—The calcareous deposits I have alluded to in No. 4, may be divided into two classes—ancient and modern. The latter, is still supposed to be in process of formation. Observations tending to show the various rates of progressive accumulation of the latter, and the rationale of its deposition under various conditions, would be instructive.

6.—Chemical analysis of the water in the springs and rivers of India during the dry and rainy seasons. From a careful examination of the latter an approximative idea might be obtained of the nature and quantity of calcareous and other matter, annually added from the land to the waters and bed of the ocean.

7.—There are large plateaus of sandstone on the summits of some of the ranges in the Ceded Districts, covered with ripple marks,—the general direction of which, and the slope of the country, show that the current of water that flowed over these beds anterior to their consolidation, must have had a south-easterly direction. I cannot call to mind that ripple marks have yet been noticed on the sandstone formations of India: but it is highly probable they do exist; and it would be desirable to search for them and note their direction, bearing in mind that the course of the great diluvial stream that flowed over these sands and clays, would be at right angles to the general direction of the ripple lines.

8.—From certain appearances near Nellore, Madras, Mavellipuram, and the present mouth of the Cauvery, it is certain that the sea in these particular localities on the Coromandel coast has advanced on and submerged considerable tracts of land; and two cities, according to tradition (at Mavellipuram and the ancient embouchure of the Cauvery), are now covered by the waves. The sea appears to be receding, or, more correctly speaking, the land appears to be rising in these particular localities. It is probable that, as on the Swedish coast, certain parts of the Coromandel coast, instead of participating in the progressive elevation of the land, suffer a lowering of level; while other portions remain stationary. I have observed similar indications of the sea having covered various parts of the Malabar, or western coast, to a considerable distance inland, in the existence of a former bed of the ocean a few feet under the present surface of the ground, as we find it at Madras. The present town of Bararoor, north of Mangalore, and supposed by Rennell and Robertson to have been the Barace of ancient geographers, and which is now situated two or three miles from the mouth of the river, is traditionally said to have been situated close to the sea-shore, and its port frequented by large ships from all quarters of the globe; extensive tracts of marine sand and pelagic remains, a considerable distance inland, and the discovery of the hull of an antique vessel of considerable dimensions, and of a construction not known to the natives, buried in the earth, several miles inland near Cannanore, corroborate this tradition. Some of the Brahmins do not hesitate to assert that the whole of the coast was raised up from the bed of the ocean for their exclusive use.

Nothing but small native craft can now ascend the river to Bararoor, and its trade in consequence has been greatly diminished. The ancient town and fort of Calicut is said to have stood on a bank, now submerged by the sea, a little to the south of the present site. It would be desirable to mark and register the rocks now, as those on the shores of the Baltic have been done, at various places along both coasts, in order that the respective limits of these supposed undulatory movements may be traced satisfactorily at some future period.

9.—Observations on the terrestrial and marine deposits now accumulating at the estuaries of large rivers and backwaters, particularly in those of the Malabar coast, both as regards the way in which the accumulation takes place, the degree of mixture and relative proportion of the marine and terrestrial deposits, and the quantity annually deposited. Observations on the causes affecting alterations and shifting of the mouths of rivers would also be interesting.

10.—Investigations into the nature of the beautiful dendritic appearances observed between the layers of the laminar limestones and clay-slates of India, and those in the interior of moss stones, mocha stones and agates, usually attributed to metallic infiltration. A specimen of the Talicota limestone from the Rastia's territory exhibited appearances so strongly characteristic of the vegetable kingdom, as to induce me to send it to Dr. Wight, who kindly examined it, and stated his opinion of its being a species of fucus.

11.—Accounts of the geology of India, south of Madras to Cape Comorin.

12.—Boring experiments through the limestone and sandstone formations of Cuddapah and Kurnool, and through the carboniferous strata in the laterite near Quilon and Cannanore, discovered in 1832 by

Colonel Cullen, also through a similar formation at Baypoor near Calicut, and through the strata in favourable situations between these localities, which should be carefully examined for a continuation of the carboniferous bed or basin.

13.—A description of the geognostic position of the fossiliferous strata between Torioor and Womaloor, near Tattan about 10 miles south of the Pachamalley hills, with specimens.

14.—Do. of the magnesite formations of Yedichicolum, and other localities in the valley of the Cauvery.

15.—Do. of the corundum mines, in the same localities, principally at Veralimodos, near Sholasigámany, Cocarambady, in the Permutty taluk; also near Namcul. Mr. Fischer of Salem, informed me that he discovered a fine ruby imbedded in the corundum at Viralimodos, which was valued at forty pagodas. A description of these localities was expected from the able pen of the late lamented Dr. Benza, and it is to be hoped will be published by his executors, if not in print already.

16.—On a recent visit to the beryl mine of Pattaley, in the Kanghyum taluk, near Coimbatoor, I was informed by the natives that the beryl is also dug at a place called Vaniambady, at the northern base of the Neilgherries; farther information on this subject is desirable, as I cannot hear of this gem existing any where in Southern India except in these two localities. It may assist the observer in his search, to recollect that its matrix, both in Siberia and at Pattaley or Poddioor, is the cleavelandite.

17.—A description and specimens of a sulphuriferous soil, stated by the natives to occur in the Wodiapolliam jungle, south of Wolandoorpett, Southern Arcot, covering an extent of low swampy ground. Mr. Fischer, to whom specimens were sent, informed me that the sulphur is seen on the surface after rains in a yellowish crystalline form. He also kindly furnished me with a small quantity of the earth, which is friable and of a brown colour. The Wodiapolliam jungle he describes to be part of a jungly belt that extends, east and west, across the peninsula.

18.—The tracing of the sandstone and fossiliferous beds of Pondicherry, southward of the Gingee river. From the circumstance of specimens having been brought me by the natives, I think that the former, and possibly the latter with which it is associated, extends into the Verdachelum taluk of South Arcot, in a S. W. direction.

19.—A description of the extent, accompanied by a suite of specimens, of a bed of shell limestone, which I found between Hyderabad, and the city of Beder. This bed may be a continuation of a similar one discovered by my friend Lieut. Wyndham, at Koolkunda and Digaye, between Muktul and Gulberga. I regret that severe illness prevented my examining these strata as minutely as I wished, and from procuring more satisfactory specimens than those I sent the Society, which are utterly insufficient for the purposes of classification. In both situations the shell limestone occurred at the southern edge of the great overlying trap formation of the Deccan, and considerably indurated; often passing into chert.

20.—An account of the rocks and deposits in the locality near Hingoli, in which the fossils lately discovered there occur. It is stated to have been found in the common dark coloured soil, but most probably has been transported there from some fossiliferous bed in the vicinity.

21.—Description of the magnesite bed in the vicinity of Hoonsoor, in Mysore.

22.—Farther observations on the laterite overlying the basalt, amygdaloid and wacké of the great trap formation of the Deccan.

V.—*A Brief Sketch of the Life and Writings of Father C. J.* BESCHI *or* VIRAMAMUNI, *translated from the original Tamil.—By* A. MUTTUSAMI PILLEI, *Manager of the College of Fort St. George and Moonshee to the Tamil translator to Government.*

PREFACE.

[The following sketch of the life of Father Beschi has been made from my original Tamil work, at the desire of Walter Elliot, Esq. to whom I am also indebted for many useful suggestions and hints regarding the matter of the work. I also feel grateful to the very Rev. Mr. P. E. Moriarty for his kindness in correcting a portion of the translation, and likewise to the Rev. Mr. W. Kelly, for much assistance of the same description.]

TRANSLATION.

In 1822, at the instance of Mr. Benjamin Guy Babington, and under the direction of Mr. Richard Clarke, I undertook to prepare a brief history of Father Beschi's life. Mr. Clarke is eminently skilled in both the dialects of the Tamil language, and was justly admired as one of the most distinguished ornaments of the Board of the Madras

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College. Mr. Babington possesses an extensive, and a profound knowledge of Sanscrit and Tamil. Immediately on his arrival in India, he eagerly applied himself to the acquisition of these languages, and made himself familiar with their genius and beauties, by his unremitting study of the historical and scientific works, that have been composed in these dialects. After having submitted to the College an English translation of the Shen Tamil Grammar, written originally in Latin by Father Beschi, he returned to England in possession of many of the works of that ingenious and distinguished writer. Some of these he has printed since his return to Europe, and he has transmitted them to Madras, that the memory of the venerable Father may be perpetuated and honoured in his adopted country. In executing the task, which under such auspices I willingly accepted, I availed myself of the manuscripts, which in 1798 had been prepared on the same subject by Viduvan Saminada Pillei, an excellent Tamil poet, and the author of many Tamil works.

In addition to the assistance derived from this source, I was in possession of many interesting and important facts regarding Father Beschi, which I gleaned during a tour through the south, from traditionary accounts, still preserved among the people.

My journey to the south was undertaken at the desire of Messrs. F. W. Ellis, the then senior member of the College Board, and A. D. Campbell, the present senior member, for the purpose of procuring a collection of Father Beschi's works, and I gladly embrace this opportunity to express my acknowledgment to these gentlemen for having confided to me a commission so honourable, and so congenial to my feelings. In truth, Mr. Campbell and Mr. Ellis are entitled to the gratitude of all, who take an interest in the preservation and spread of the oriental languages. They are the authors of many valuable oriental works. By their example and encouragement they have promoted the study of the native languages, and rescued these from the neglect into which they had fallen after the destruction of the Madura college. No longer sustained by that institution, which had flourished under the patronage of the ancient Pandyan kings, our vernacular languages creeping, if I may use the expression, as the vine without its support, would have rapidly degenerated, and sunk into a state of rudeness, had not the distinguished individuals whom I have just named, by their unremitting exertions, and the zealous co-operation of their colleagues, succeeded in establishing the Madras College, and thrown around it the light of their talents.

Fathers Beschi and Arnold were natives of Italy, and members of the illustrious Society of Jesuits. They received their education in the Roman College, where their learning and virtue attracted the admiration of the reigning Pontiff, who selected them, on account of their eminent qualifications, for the Eastern Missions.

They arrived at Goa in the year 1700. The Reverend Father Arnold proceeded to South Malabar, where he made himself perfect master of the Malayalam and Ariyam languages, in which he composed many admirable and valuable works, both in prose and verse, explanatory of the doctrines of the Christian Religion.

The Reverend Father Beschi was appointed to the south of the peninsula. On his arrival at his mission he applied himself with assiduity to the study of the Sanscrit, Telugu and Tamil languages, of which he became thoroughly master, particularly of the latter. As soon as he had acquired these languages he employed the best part of his time in removing the weeds, which unfortunately began to cover the fountain of the Christian faith; and, in order to preserve its holy purity, he laboured with indefatigable zeal to enlarge and circulate numerous Tamil works, explanatory of that creed, which had been composed by another extraordinary man, the Reverend Father Roberti Nobili. Mr. F. W. Ellis, Asiatic Researches vol. 14, page 58, says:—" I shall close this note by the translation of a passage from a work entitled, " *Tiru-schabeiyin Charitra Postagam,*" or "*Historia Ecclesiastica,*" written in *Tamul* and published by the *Protestant Missionaries,* at *Tranquebar,* in 1799. This passage is from the section relative to the transactions of the *Missionaries* in *India,* from the arrival of the *Portuguese,* at page 238 of the work, and under the year 1607. The work therein alluded to, as having been written in 1729, is by the famous *Jesuit Missionary* Constantio Josepho Beschi, known throughout the South of India for many valuable compositions in the high dialect of the *Tamul,* under the title of the *Vira-Māmuni or Dhairya Nātha-Swāmi.* This extract is from the preface to the *Vēda Viluccam, the Elucidation of the Scriptures.*"

TRANSLATION.

" [1607] At that time Roberti Nobili, called Tatwa-Bodhager, clothing himself in the habit of a Sanyasi, endeavoured to promulgate Christianity in this country. The secretary to the Congregation de Propaganda Fide, wrote in 1676 to Pope Innocent, that Roberti Nobili, although he called himself a Brahman, was not guilty of falsehood*."

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* " The fact is that Roberti Nobili uses the word *Brahmana* always in the sense of priest, as indeed it is rendered though not with precision by Sir W. Jones in the Institutes of Menu ; thus he calls the high priest of the Jews and his associates *Yéda-Brahmans,* and the father of the church *Bráhma-Vadigal.*"

He is represented with this habit and appearance in a picture in the convent of the 'paulist's at *Rome*, under which is the following inscription,—' "Father Roberti Nobili, a paulist of the city of *Rome*, and of an illustrious family; a godly and learned personage, who laboured to convert the heathens 45 years, eating nothing but rice and vegetables, and died happily at Mylapoor (*St. Thomé* near *Madras*) on the 16th January 1656." 'That which was written at *Yélacúrchi* (the principal residence of Beschi) in 1729 in his praise is as follows:—' "As the resplendent sun runneth his course in the firmament, but alloweth not his radiant face to be seen, so although St. Thomas, one of the twelve disciples of our Lord Jesus, and St. Xavier, far renowned for innumerable miracles, entered and preached the Gospel throughout this country, yet for a long time the darkness thereof was not dissipated. At last, as if the obscurity of the night, that elsewhere lowereth over all, had been dispelled by the rising of the sun, it pleased our Lord to turn his gracious eyes towards this country covered by paganism as by a cloud, and one hundred and twenty-two years past, to send hither orthodox priests to enlighten all souls. Tatwa-Bodhaca Swami, who then appeared steadfast in austere devotion, confirmed in the true faith, and perfect in virtue, was first sent by the Lord, and long resided here, bright as the morning star. Are not his *Cándam* (the *Jyána-bodhaca Cándam*) which, from soundness of religious doctrine, seems as if written in rays of light, and his other works, well known and received as a sun of everlasting brightness that hath never set. From that time to this, innumerable priests, devoted to their duty, have succeeded each other in succession, like an undivided garland."

Father Nobili had taken the title of Roman Brahman and was an incomparable Sanscrit pundit and poet. (His life and writings are about being published in a work, called the Hindoo Christian Observer). Father Beschi's anxiety was to produce abundant fruits on the tree of the Christian faith, which had been planted by St. Thomas the Apostle, and nourished by the zealous labours of St. Francis Xavier. Accordingly he defended the true faith from the attacks of its enemies, who viewed its prospering growth with envy, and exerted all his zeal to preserve it from decay. He spared no pains in composing luminous Tamil works, explaining the Christian faith. The rapid publication of these works, and the examples of all the various species of eloquence with which they abound, have stamped upon them a character of excellence, which every reader of them is anxious to admit. Although they were written above one hundred years ago, their language has undergone no change, not one word has become obsolete or suffered that variation which the words of living languages constantly undergo. They are therefore entitled to the attention of all.

Father Beschi's next step was to study the works of the several eminent Hindu philosophers, devotees, ascetics, &c., such as those of Tiruvalluvar and others; and, after he had made himself perfectly acquainted with them, he began his ministry with that success which always accompanies a bold and popular eloquence. Instead of wasting his time in merely lopping the branches, he struck at the root of heathenism, and attacked the doctrines and disciplines of the several sects, with a vehemence peculiar to himself, but admirably suited to the temper and taste of the age. Long before his arrival, the Reverend Roberti Nobili composed many works, as above stated, which shook the science and philosophy of heathenism, and laid open to many of the Indians the imposture and absurdity of their established superstitions. Animated with an equal zeal, the Reverend Father Beschi boldly erected the standard of truth, and defended it with an unconquerable intrepidity.

From the time of his arrival in this country, he abstained from the use of flesh, fish, &c., and employed two Tamil youths to dress his food according to the Hindu custom, partaking of it only once in the day. When at home, he wore on his head a velvet cap; the remainder of his dress consisted of a cloth, with a narrow red border, tied round the waist by another cloth of a light purple colour, and of sandals for his feet—his costume was the same as that worn by the Hindu devotees. When abroad, he wore a long gown of light purple colour, with a waist-band of the same colour; on his head was a white turban, covered with a purple cloth, in his hand he carried a handkerchief of the same colour—his ears were adorned with a pair of pearl and ruby ear-rings—his fore-finger with a gold ring. A long cane in his hand, and a pair of slippers on his feet, completed his out-of-door dress. His conveyance was a palankeen, having a tiger's skin for him to sit upon, two persons attended on either side of the palankeen to fan him—a third person carried a purple silk umbrella, surmounted with a golden ball, whilst two others carrying a bunch of peacock's feathers proceeded in front, and whenever he alighted from the palankeen he sat down upon the tiger's skin. In order to preach the gospel with full effect, and to make converts to Christianity amongst the heathens, he made himself perfect master of the Hindu sciences, opinions and prejudices, and conformed to their customs in matters of indifference. In this manner he visited different countries, exposing the fallacies of their doctrine, and the absurdities of their religious practices. He is much extolled for the triumphs he obtained in the controversial disputes, which often occur amongst the learned in India. He was very liberal in his donations to the poor, and in the erection and repairs of churches. He was assiduous in instructing the youth in different languages and sciences, and in procuring for them situations suitable to their capacity. The first church he erected, was at Conāngooppam Aryanoor, in the district of Paroor,* which then belonged to Mootoosamy Cachirayen, a poligar chieftain. After its completion, Father Beschi proceeded to Mylapoor, and solicited the then bishop of that diocese, to procure for him, from Manilla, an image of the blessed Virgin Mary, in the native dress, with the child Jesus in her arms, according to a model he had drawn for that purpose. The prelate complied with his request, and on its arrival, he performed a devotion of 11 days; and, on the 12th, placed the image in the church which was dedicated to God in the name of the Virgin, Mother of our blessed Redeemer. He founded another church at Tirucavalur,† and dedicated it to the blessed Virgin under the title of Mother of Refuge. It was erected on the land granted to the Christian church, situated at Elacurichy, by Mazhavarāyen. He composed 15 poems in praise of the blessed Virgin Mary.

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* Virttachellum talook of South Arcot.

† Inscription engraved on the stone set on the bank of the tank behind the church at Tirucavālūr, in the talook of Arialoor, Trichinopoly collectorate.

ஸ்வஸ்தஸ்ரீ சாலிவாகன சகாப்தம் - ௲௬௱௫௰௭ - ராக்ஷத௵ ஆடி௴ ௨௰௬௳ ஸ்ரீமதுராசமானிய-ராசஸ்ரீ அரியலூரரசினில்லிட்டரங்கப்பமழவராயர் ஏலாக்குறிச்சித்திருக்காவலூரில்வீரானதேவன் வழிக்குக்கிழக்கு-கோவிலூர் வழிக்குமேற்குக்குட்டைக்குத் தெற்கு- பெரியஏரிக்குவடக்குப்பட்டயாவுஞ்சர்வேசுரன்கோயிலுக்குச் சிலாசாதனமாகத் தந்தோம் - சந்திராதித்தருங் கல்லுங்காவிரியும் புல்லும் பூமியுமுள்ளளவுஞ் சுகமேயிருக்கவும் - இதத்தருமத்துக்கு யாதாமொருத்தன் விகாதஞ்செய்தால் கங்கைக்கரையிலே காராம் பசுவைக்கொன்ற தோஷத்திலே போகக்கடவான்.

TRANSLATION.

Swasti Sri (may happiness and prosperity attend). In the year Ratchada following the year 1657 of Salivahna (corresponding with A. D. 1734), on the 26th day of Adi-Srimadu, Rāyamāniya Rājestri Rungappa Mazhavarāyer, whose seat of government is fixed in Ariyalur, has caused a stone to be engraved, and granted the whole of the land situated within the limits, from the east of Vīrān dēwan road, to the west of Kovilūr road, and from the south of the pond to the north of Periya Yeri, at Yēla-Curichy Tirucavalūr, for the use of the church of the God of all—to enjoy as long as the sun and moon endure, as well as the stone, the river Cauveri, grass and earth exist; if any one act contrary to this charity, may he incur the sin of killing a black cow on the banks of the Ganges.

Works written in Tamil by Father BESCHI—*chiefly intended for the use of the Hindu Christians.*

POEMS.

1.—Tembavani*—In honour of the Lord Jesus, the blessed Virgin and St. Joseph. He produced in 1726, the sacred poem called Tembavani, which is by far the most voluminous of his works. It contains 3615 tetrastichs in thirty cantos. To which he added in 1729, to each verse a prose interpretation. The poem comprehends many religious disquisitions and explanations, descriptive of true religion, together with one hundred and five historical passages, taken from the old and new Testaments. It is a work of such great genius and vast erudition that it is admired by all who read it, not only for the sublimity of the thoughts, and the learning it displays, but also for an elegance and purity of style which, it was imagined, no foreigner could acquire. A talent so felicitous and extraordinary has been ascribed to divine assistance.

The poets unanimously acknowledged Father Beschi as their tutor, and with his own permission bestowed on him a high and well merited distinction. Instead of Dyrianatha Swami, that is Father Constantine, which was the name he had borne since his arrival in India, they substituted, the title of Viramamuni, or the "Great Champion Devotee."

Agreeably to the rules of versification laid down in the grammars, the celebrated Tamil poems called Chintamani and Ramayanam, as well as other Indian poems, contain six kinds of rhymes, and these promiscuously used; but the Tembavani is composed in the first sort of rhyme† only, a species of versification difficult to be sustained, but greatly admired for its excellence. With respect to the சந்தம் or cadence, Viramāmuni says in the Shen Tamil Grammar, translated by Mr. Babington, "On this principle, it is very easy to invent new சந்தம் or cadences. Those who are unacquainted with this art, applaud the poet Camben, because in his Ramayanam, which contains 12,016 stanzas, he has introduced 87 varieties of cadence: but in my poem Tembavani, which contains only 3,615 stanzas, I have without any difficulty employed 90 such variations. Indeed it would have been easy to give a different cadence to every stanza; but this could not have been done with propriety, as the same cadence is usually preserved through ten, fifteen, or more stanzas."

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* See Ellis's translation of the Cural, pages 17, 23, 25, 35, 45, 50, 88, 100, 101, 141. Vide appendix of this book. See page 3 of the preface to the Adventures of Gooroo Paramārtan, a tale in Tamil, accompanied by a translation of Mr. B. G. Babington, who says "Tembavani, which, vying in length with the Iliad itself, is by far the most celebrated and most voluminous of his works. To judge from the only padalam or canto, which I have had an opportunity of reading, where the murder of innocents is described, its merits are not over-rated."

† Vide Mr. B. G. Babington's Shen Tamil Grammar, page 75. "If not only the second syllable of each line in the stanza, but the whole of the first foot, with the exception of the first letter, be the same, the verse is esteemed, in proportion to the difficulty of the performance. Thus, if, where (கருவி) caruvi occurs in the first line, (ஒருவி), euruvi (அருவி), aruvi (உருவி) ooruvi, &c. come in the other lines, the verse will be particularly admired.

Mr. Babington on his return to England took with him a copy of the Tembavani in two volumes folio.

When Sir John Malcolm visited the College of Madras in 1817, Mr. Ellis, in shewing him a copy of the Tembavani, written on cadjan, dwelt largely on the merit of that work. Sir John not only expressed his great admiration of the work but also requested that, as Europeans so rarely acquire a perfect knowledge of Indian poetry, or compose poems of such extent and excellence, in any of the eastern languages, Mr. Ellis would procure him a copy of the Tembavani in cadjans, to take with him to England, for the purpose of placing it in Lord Spencer's library. Accordingly a copy of it was made in cadjans, the two boards of which were ornamented with silver and gold. It was transmitted through the Government of Fort St. George, to Sir John Malcolm, when he was Governor of Bombay, by the College Board of Madras.

I am[*] happy to state that I have the honour of possessing the copy of the Tembavani, written by Father Beschi's own hand.

A specimen of Father Beschi's poem translated by Mr. Ellis, as also the Reverend Mr. E. Hoole's, are added in the appendix, No. I, at the end of this paper.

2.—Tirucāvalur Calambacam;[†] 3. Ādeikala Mālei, and 4. Calivenba. Father Beschi composed these three poems in honour of the Madonna, to whom the church at Tirucavalur was dedicated.

5.—Annei Azhemgal Andādi. The poem of the sorrowing Mother, or the lamentation of the Mother of our Lord on his crucifixion. It consists of 100 stanzas composed in the measure called Andādi, in which each stanza commences with the same word that terminates the preceding one.

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[*] On my arrival, during my journey abovementioned, at a place called Avoor, twenty miles south of Trichinopoly, I found the Tembavani in Beschi's own hand-writing, in possession of Luz Naig, son of Bungaroo Naig, Beschi's disciple. In compliance with my request, Luz Naig brought the book to Madras for the inspection of Mr. Ellis, who purchased the work for 300 rupees. After taking a copy of it for his own use, that gentleman kindly presented it to me. Mr. Josiah Hudleston purchased Mr. Ellis's Tembavani, when his effects were sold by auction.

[†] Calambacam—a sort of poetry in which the author mixes at pleasure all kinds of verses. This variation in the measure renders the composition pleasing to the ear, but difficult to those who compose or recite it.

6.—Kittēri Ammal Ammānei. An account of the life and martyrdom of the holy Virgin Kitteri, daughter of Sinakāyen, king of Lusistan who suffered with her eight sisters on the mountain of Bomber, in the year 130, A. D. A poem in 1100 couplets, divided into ten parts.

This probably refers to Quiteria or Citheria, a holy Virgin and martyr of Spain. Martyrologium Romanum, p. 130—Calendar 22d May.

Moreover there are numerous fragments of poems in different kinds of rhyme in honour of the Lord Jesus, and the blessed Virgin Mary, &c.

Works written in prose.

7. Vedhiar Ozhuccam. (The following translation of its contents is by the Reverend Mr. E. Hoole, a Wesleyan Missionary). " It contains clear definitions, offers powerful, and presents affecting appeals, with regard to the work of this class of teachers. It is divided into twenty chapters. The first chapter treats of the nature of the office of catechist; the second, of its importance; the third, of its universal obligation; the fourth, of the preparation to the office; the fifth, of the necessity of self government in those who would save others; the sixth, of caring of others in order to self preservation; the seventh chapter shews that the first means for the salvation of others is personal piety; the eighth, the second means is prayer; the ninth, the third means is desire; the tenth chapter presents motives to quicken a desire for the salvation of others; the eleventh treats on self diffidence and entire reliance on God in the execution of the office: the twelfth, on regarding the souls and not the outward condition of men; the thirteenth, on shewing love to others; the fourteenth, on shewing no desire for the wealth of others; the fifteenth, on regarding the proprieties of time and place; the sixteenth, on yielding to others in order to win them; the seventeenth, on not giving way to discouragement from want of success; the eighteenth, on unity among themselves; the nineteenth, on helps to the office of catechist; the twentieth is an exhortation on attention to the instructions. The whole concludes with questions and assistances for self-examination with regard to duty towards God, personal piety, family religion, duty towards ministers, duty towards the church, duty towards the heathen, duty towards dying persons, duty with regard to hindrances in the performance of the office: and a number of pithy proverbs to be fastened on the memory."

8. The Vēdha* Vilaccam, or illustration of religion. (The following translation of the contents of this book is by Mr. E. Hoole). "The first chapter treats of the rise of protestanism; the second chapter recounts the divisions in the protestant church; the third defends the worship of saints; the fourth, the worship of the Virgin Mary: the fifth assert the antiquity of such worship; the sixth defends the worship of images; the seventh asserts the antiquity of such worship; the eighth is on the decrees of the church; the tenth asserts that the Romish church is the only true church; the eleventh is on purgatory; the twelfth on the sacraments generally; the thirteenth, on the sacraments particularly; the fourteenth, on transubstantiation; the fifteenth, on the sacrifice of the mass; the sixteenth, on the holy Scriptures; the seventeenth, on the miracles of the church; the eighteenth, confirmation of what had been advanced. The work concludes with a confession of faith on the principles defended in it.

"The book then closes with the particulars of the place, date, and quantity of the composition, and the author's name. It is dated 1728."

9.—Pedagamaruttal—Refuting differences.—This work arose out of the circumstances related in the preceding note, and is a reply to the church history of the Tranquebar missionaries, which, instead of 300 pages as stated by Mr. Hoole, consisted according to Beschi of only 13 pages, and was, probably, a totally different work. A copy of it was sent to them by Beschi, but the controversy does not appear to have proceeded further.

10.—Gnana-Unarttal.—Instructions of wisdom.—Remarkable for the beauty, ornament, and elegance of its language. It commences with the most simple, and gradually ascends to the most elevated style of composition. This book was particularly composed as a guide for the preachers of the Gospel.

11.—Tiruchabei Canidam.—A treatise on astronomy, and designed for the use of the church in fixing the observance of Ash-wednesday, and other festivals. This work is in verse and prose.

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* This work was composed by Beschi in consequence of an attempt made by the Danish missionaries to circulate, in the vicinity of Tirookavaloor, where Beschi resided, a translation of the new Testament. The missionaries had deputed a zealous catechist for that purpose, and provided him with a large supply of their own version.

Mr. Hoole says that "the publication of a Church History in Tamil, an octavo volume of more than three hundred pages by the missionaries of Tranquebar, afforded perhaps the most suitable answer this work could receive. I was told at Tranquebar that a copy of that History was sent to Beschi, who never ventured to impugn its statement."

In putting forth this statement, Mr. Hoole does not seem to be aware that the work called Pedagamaruttal, the next on the list, was specially composed on this occasion.

Works written in Tamil and Latin, by Father Beschi, *chiefly intended for the use of the European missionaries, &c.*

12. Low Tamil Grammar in Latin, entitled Grammatica Latino-Tamulica, in qua de vulgari Tamulicæ Linguæ Idiomate கொடுந்தமிழ் dicto, Fusius Tractatur. Auctore P. Constantio Josepho Beschio, E Societate Jesu, et in Regione Madurensi, apud Indos Orientales, Missionario.

This is a complete Grammar of the low, and an excellent key to the high dialect. It contains moreover, in a supplementary chapter, "De variis quotidiano usui præcipue necessariis," a variety of information of the greatest practical utility to those, who, by their situation, are compelled to daily intercousre with the Tamil natives. This Grammar was printed for the first, and I believe, the last time at the Protestant Missionary Press at Tranquebar, in 1738, and from copies of this impression, which is not common, an English translation, which, however, cannot be recommended, has lately been published at the Vepery Press.

The College Board printed Beschi's Low Tamil Grammar in Latin, in 1813.

Shen Tamil Grammar.

The Author's Introduction.—C. J. Beschi—*To the pious Missionaries of the Society of Jesuits, Greeting.*

"When I last year presented you with a grammar of the common dialect of the Tamil language, with the view of aiding your labours as ministers of the gospel, I promised that I would shortly say something respecting the superior dialect; but my time being occupied by more important duties, the work was deferred longer than I had at first expected. Urged, however, by the pressing solicitations of my friends, no longer to delay making public the information which I had amassed by a long and ardent study of the abstruse works of ancient writers, but to communicate the fruit of my labours, I resolved to avail myself of the little leisure which I could spare from more weighty avocations, and freely to impart what it had cost me no inconsiderable pains to acquire. I was further encouraged to the task, by my sense of the very favourable reception which my introduction to the common dialect had universally met with. Let me intreat the same indulgence for the present work. That the study will be one of considerable difficulty, I do not pretend to deny; but the labour will not want its reward. Among the natives themselves, very few can now be found who are masters of the higher dialect. He among them who is acquainted even with its rudiments, is regarded with respect; but should he quote their abstruse works, he is listened to with fixed admiration; what praise, then, would they not bestow on a foreigner, whom they should find deeply versed in a science which they themselves consider scarcely attainable? They will readily attend to the teaching of one whose learning is the object of their admiration. And as this may evidently lead to the honour of religion, and promote the salvation of those about us, I am satisfied that this consideration alone, operating on zeal like yours, will suffice to excite you to the study of this dialect, notwithstanding the difficulties that attend it.

"But since almost all the Tamil works in this dialect are in verse, I trust you will not deem it improper, if I venture to draw your attention to heathen poets, and to the study of poetry. In former times, St. Jerome was severely censured for having, by the introduction of examples from the poets, sullied the purity of the church with the pollutions of the heathen. St. Jerome, in his learned reply, demonstrates, that the apostle Paul repeatedly cites from the poets, in his epistles, and that the most exemplary among the fathers not only made frequent use of illustrations from the writings of laymen, but that, even by their own poetry, they, far from polluting, embellished the church. These remarks apply with particular force in this country, the natives of which are swayed not so much by reason as by authority; and what have we from their own authors to adduce in aid of truth, except the verses of their poets? For, since all their writings are in verse, they have reduced to metre their rules of art, and even the rudiments of their language: whence, they naturally suppose, that he who does not understand their poetry, is totally ignorant. Moreover, there are excellent works in Tamil poetry on the subject of the divine attributes and the nature of virtue; and if, by producing texts from them, we turn their own weapons against themselves, they will blush not to conform to the precepts of teachers in whom they cannot glory without condemning themselves. If we duly consider what has been said, we shall be satisfied, that, in this country especially, it is highly proper in a minister of the Gospel to read the poets, and to apply himself to the study of poetry.

"The first person who wrote a grammatical treatise on this dialect, and who is therefore considered as its founder, is supposed to have been a devotee named Agattiyan, respecting whom many absurd stories are related. From the circumstance of his dwelling in a mountain called Podiamalei, in the south of the Peninsula, the Tamil language has obtained the name of தென்மொழி, or *Southern*, just as the Grandonic is termed வடமொழி, or *Northern*, from the supposition that it came from the northward. A few of the rules laid down by Agattiyan have been preserved by different authors, but his works are no longer in existence After his time, the following persons, with many others, composed treatises on this dialect, viz. Palacàyanàr, Ageiyanàr, Nattattanàr, Mayesurer, Cattiyanàr, Avinayanàr, Càkkeippàdiniyàr. The works of all these writers have perished, and we know that they existed only by the frequent mention of their names in books which are now extant. One ancient work, written by a person called Tolcăppiyanăr (*ancient author*), is still to be met with; but, from its conciseness, it is so obscure and unintelligible, that a devotee named Pavananti was induced to write on the same subject. His work is denominated *Nannul*, a term that corresponds exactly to the French *belles lettres*, and the Latin *litteræ humaniores*. Although every one is familiar with this title, few have trod even on the threshold of the treatise itself. The author divides his subject into five parts, which are comprised in the following line :—

எழுத்துச்சொற்பொருளியாப்பணி

" 1st. எழுத்து—Ezhuttu—*Letters*. This head treats on pronunciation and orthography.

" 2d. சொல்—Chol—*Words* ; which are composed of letters. This head treats of the noun, the verb, and the other parts of speech.

" 3d. பொருள்—Porul—*Matter* ; or the mode in which, by uniting words, a discourse is formed. This head treats on amplification, the affections of the mind, &c. It is subdivided into *agapporul*, and *purapporul*; that is to say, into *matter interior* and *exterior*, The former relates to the passions and affections of the mind, which act on man internally ; the latter, to things external to man.

" 4th. யாப்பு—Yappu—*Versification*. The Tamil writers confine their remarks on this head to the subject of prosody, and say nothing of the art of poetry.

" 5th. அணி—Ani—*Embellishment*. This head treats on tropes and figures.

The term *Panjavilaccanam*, which we here used, is the general expression for these five heads.

" Pavananti not having completed his design, his *Nannul* comprises only the two first heads, viz. *Letters* and *Words* ; on each of which he has treated at considerable length. On his death, a person, named Narccaviraja Nambi, took up the subject, and wrote on the third head, or *matter*. A devotee called Amirdasagaren (sea of nectar), composed a treatise on the fourth head, or *Versificaion*, which he entitled *Carigei* ; and lastly, a person named Tandi wrote on the fifth head, or *Embellishment*: his work was called from him *Tandiyalancaram* ; the word *alancaram* being the same as *ani*.

"On *Amplification* and *Embellishment*, the third and fifth heads, I shall say nothing; because my readers are already acquainted with the rhetoric of Europe, to which nothing new is added by the Tamil authors. As I have also treated fully on the *Letters* in the grammar of the common Tamil, the remarks which I shall here offer on that subject will be confined to the peculiarities which exist in the superior dialect. This work will, accordingly, be divided into two parts; the first of which will relate to *Letters* and *Words*; the second, to *Versification*. Under the latter head, I shall take occasion to say something respecting the art of Tamil poetry.

"In the course of this work, much will be purposely omitted, either as being not of frequent use, or attainable by a little practice: my object being, merely to explain the first rudiments of the language, and thereby to remove the more prominent obstacles which oppose its attainment.

"I shall frequently adduce examples from the most esteemed authors; with the view, as well of illustrating the rules which I may lay down, as of initiating the student into the practice of the language. As many of these examples will appear without the name of the author being annexed, it becomes necessary to explain, that the Tamil writers do not usually prefix them to their compositions; and although the names of some have been banded down to us by their commentators, yet the number of commentaries which have been written on poetical works, is small; and even in these, the author's name is not always mentioned. For instance, the commentator on the poem *Chintamani* speaks in terms of praise of its author, whom he styles the master of all the learned. He may indeed with justice be called the prince of Tamil poets, but of his name the commentator does not inform us. Nor are we to suppose that the work itself is called after its writer; Chintamani being only an appellation bestowed on the hero of the poem, whose name is Sivagan. In like manner, we learn that the poet so well known under the name of Tiruvalluven, who has left us a work containing 1330 distichs, was of the low tribe of Paraya, but of his real name we are ignorant: for although he had no less than seven commentators, not one of them has mentioned it. *Valluven*, is the appellation by which soothsayers, and learned men of the Paraya tribe are distinguished; and *Tiru* here signifies *divine*, in the sense in which we say *the divine Plato*. Such is the origin of this honorary title, which has now come to be used as the real designation of the person to whom it is applied. Again, we have a collection of moral sentences, worthy of Seneca himself, written by a woman, who, if we may believe tradition, was sister to the last mentioned author; but her real name also is unknown, although she is always called *Auviyar*, a title which is appropriated to aged matrons. There is another work which I shall occasionally quote, and the title of which is *Naladiyar*, which contains 400 epigrams on moral subjects. The origin of this name is said to be as follows: eight thousand poets visited the court of a certain prince, who, being a lover of the muses, treated them with kindness, and received them into favour: this excited the envy of the bards who already enjoyed the royal patronage, and in a short time they succeeded so completely in their attempt to prejudice their master against the new comers, that the latter found it necessary to consult their safety by flight; and, without taking leave of their host, decamped in the dead of night. Previous to their departure, each poet wrote a *venba* on a scroll, which he deposited under his pillow. When this was made known, the king, who still listened to the counsels of the envious poets, ordered the scrolls to be collected, and thrown into a river, when 400 of them were observed to ascend, for the space of four feet, *naladi*, against the stream. The king, moved by this miraculous occurrence, directed that these scrolls should be preserved; and they were accordingly formed into a work, which, from the foregoing circumstance, received the name of *Naladiyar*.

" I have now said all that I think necessary by way of introduction to this work. In conclusion, I have only to assure the student, that if he will apply himself to the perusal of the ancient authors, he will find their writings to be by no means undeserving of his attention. Farewell! Ides of September 1730."

14.—The Clavis Humaniorum Tamulica Idiomatis, containing five parts complete, like Tonnul Vilaccam in Tamil. It is in manuscript.

15.—Vāmen Cadei—a Tamil story, with a Latin translation, for the readers of high Tamil. This is not printed.

16.—Paramarta Gooroo Cadei—a tale in the Tamil language, for the readers of the common Tamil. This is translated into English by Mr. Babington, and printed in London, in the year 1822.

17.—A Dictionary Tamil and French.

18.—Do. Portuguese, Latin, and Tamil.

19.—Do. Tamil and Latin.

20. *Antalogium Tamulica. This work of great merit could not be found, notwithstanding my diligent search in many places when I

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* I suppose Mr. Ellis means the following book, vide Shen Tamil Grammar, page 103. " If I should hereafter have sufficient leisure, it is my intention to make a collection of these expressions from their best authors, and thus to form a Tamil Parnassus."

was sent to the southern country by Mr. Ellis, with particular direction to find out the work.

21. A Latin translation of the two first parts (Arappal and Porutpal) of the Tiruvalluver Cural.

I am enabled to supply some information regarding this work. In 1816 I was sent by the late Mr. Ellis, and Mr. A. D. Campbell, to the south, to procure useful works for the College. In my search for books of that description, I found amongst several works of merit a Latin translation of the Cural, which I forwarded along with other manuscripts to Mr. Ellis. I beg to add an extract from that gentleman's reply to a letter, which on that occasion I had the honour of addressing him, regarding the translation of the Cural.

"The books have arrived safe and I commend your diligence in collecting them. Viramamuni's commentary on the Tiruvalluver Cural is exceedingly valuable, and you must use all your diligence in completing the copy and in endeavouring to bring the original with you to Madras, so that I may be able to compare them and to complete the correction of the copy. Should it be necessary for you to remain longer to the southward on this account, do so, as it is of great consequence that an entire copy of this excellent work should be procured for the College.

"Be diligent in enquiring after another work of Viramamuni and for any other books that may be of use to the College.

(Signed) Yoûrs F. W. Ellis."

"*Madras*, 27*th September* 1816."

I further beg to add some particulars which I learned from the sons* of Beschi's catechist, regarding the original copy of the Latin translation of the Cural. There were two original copies of that work—one without, another with the Tamil text of Tiruvalluver. It was not known who wrote the former, but it was supposed to have been written by Beschi, and it is well known to the sons of Beschi's catechist, that the latter was written by the Reverend Father Julius Cæsar Potensa, the immediate successor of Beschi, under whom the said persons were disciples at the church situated in Porthacoody, in the district of Trichinopoly, and they were present when the said work was executed by Father Potensa. The said persons also gave me a small book which is with me still, written by Father Potensa. On my comparing the little book with the said Latin translation of the Cural, I found that both had been written by Potensa himself. On my producing both the originals to Mr. Ellis, he was unable to ascertain whether Beschi or Potensa was the translator, as there was no title page to either of the copies, but he was inclined to decide in favour of Potensa, because the manuscript was in his hand-writing. He has therefore merely alluded to this translation as the work of "the Latin Commentator," and intended to have entered more fully into the subject in the preface to his own translation, which unhappily he did not live to finish. The portion translated by Mr. Ellis himself was intended to comprehend the first part only, called அறப்பால் (Arappal) on virtue, containing twenty-four chapters.

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* Dayiriyam Pillei and Amirda Pillei, who were the sons of Chowrimootoo Pillei, Beschi's catechist, and who gave me much information respecting the life of Beschi, as well as his valuable works, and whom I met at Cariyam Putti, a village which is about midway between Tanjore and Trichinopoly.

In pursuance of this resolution, eighteen chapters of the Cural were translated and exemplified with quotations from the best Tamil authors: of these chapters which he translated, thirteen only were printed and the rest are with me still in manuscript, as Mr. Ellis died before he could finish the task he had undertaken.

Works written in Tamil by Father Beschi, intended for the use of the Hindoos in general.

22. Tonnul Vilaccam is a grammar of the superior dialect of Tamil by Father Beschi. This is not only a complete and copious grammar of the language, but, as an enumeration of its divisions will shew, embraces all that is comprised in the scholastic term *humanities*. Its several divisions are, on Orthography, Etymology, Composition, Prosody, and Rhetoric. This work as originally composed by Beschi, contains the substance of the Tolcapiam, Nannul, and other pre-existent treatises on grammar, &c. As usual the rules are in verse, accompanied by a copious explanatory commentary in prose; perspicuity and arrangement are especially attended to, so that a person moderately skilled in the low Tamil might soon make himself master of this grammar.

All the Tamil grammarians treat of certain rules for this species of writing, distinguished by the titles அகப்பொருள் or சிற்றின்பம்—*Agapporul* or *Sittinbam*, meaning sensual pleasure, and of புறப்பொருள் or படைசேவகம்—*Purapporul* or *Padeisewagum*, signifying military service; instead of which Beschi introduces a new series of compositions under the names of அறம்—(Aram)—virtue; பொருள்—*Porul*—matter; இன்பம்—(Inbum)—pleasure; வீடு—(Vidu)—final beatitude, which Father Beschi says in the third part of his Tamil Grammar, are the subjects fit to be treated upon as a guidance for authors.

In composing this work, Father Beschi not only intended to define the rules of grammar more concisely and accurately than the ancient ones, but also by means of it to establish the Christian doctrine, which he considered to be more particularly his duty than any other object. With this laudable intention, Viramamuni has taken a couplet from Tiruvalluver's Cural, and illustrated it by several quotations from the Chintamani and Ramayanam, shewing how much they fall short of the standard assumed by the poet, after which he introduces quotations from scripture, and argues from the purity of their tendency that they must have emanated from divine authority. This is introduced in the third part of Tonnul, where he lays down the rules of logic.

Mr. Ellis has translated the above said couplet, and a part of Father Beschi's illustrations, which I have added in the appendix, No. 2. See Ellis's Cural, page 88.

The Tonnul Vilaccam, was lately printed at Pondicherry by one of the native Tamil christians, but, I am extremely sorry to say, it is quite incorrectly done, because the proof sheets of the work were examined by an illiterate Hindoo, who, without understanding the plan of Father Beschi, made several omissions and useless additions to the work.

23.—The Sadur Agaradi—a dictionary of the superior dialect, likewise composed by Beschi: it in fact consists of four distinct dictionaries—the first, *Peyer*, shews the several meanings of every word—the second, *Porul*, the several words bearing the same meaning—third, *Togei*, shews the subordinate species of the technical and general terms of science and literature, and the fourth, *Todei*, is a rhyming dictionary. This work, compiled from the various dictionaries of the high Tamil, of which there are a great number, is the only one which is entirely arranged in alphabetical order, the words in the others (a few sections excepted, in which the alphabetical form is used from necessity) being collected into general classes, and resembling, therefore, vocabularies rather than dictionaries, except that they are more copious.

This work was printed by the Board of Superintendence for the College of Fort St. George, in the College press, in 1824, and re-printed by the Reverend Mr. J. Smith, a protestant missionary of the London Missionary Society, at the Church Mission press at Madras, in the year 1835.

Father Beschi was distinguished for his piety, benevolence and learning. To the conversion of idolators his principal efforts were directed, and they were uncommonly successful on several occasions. He displayed much skill in solving various subtle questions with which his adversaries endeavoured to ensnare him.

On an occasion when he was making a missionary circuit, he happened to halt in a village named Vythisweram Covil, and during his walk through the place, he approached a pagoda, where he observed a concourse of people, some of whom he interrogated respecting the deity to whom the pagoda was dedicated. They replied that it was dedicated to Vineideerthan, and that the blind, lame, &c., were cured by a pilgrimage to this pagoda: whereupon Viramamuni immediately composed the following verse:—

வாதக்காலாந்தனக்குமைத்துனர்க்குநீரிழிவாம்
போதப்பெருவயிறும்பிள்ளைக்கு-ஓதக்கேள்
வத்தவினைதீர்க்கவழியறியான்வேளூரான்
எத்தவினைதீர்த்தானிவன்.*

He who is afflicted with elephantiasis; his brother-in-law with diabetes, his son with a pot-belly, and, moreover, this same Veloorân, being unacquainted with medicine to cure his own disease, what sickness can be healed by such an one?

The assembled multitude who heard this were astonished at his knowledge of their mythology.

Being desirous of having an audience of Chundah Saib, the Nabob of Trichinopoly, he commenced learning the Hindoostanee and Persian languages, and made himself complete master of them in the short time of three months. On his first visit, Chundah Saib, admiring the rare qualities of this distinguished divine, conferred on him the surname (عصمتي سنيا سي) Ismattee Sannyasi, indicating his excellence as a religious devotee, and presented him with a palankeen, inlaid with ivory, in which his grand-father, Sadoolah khan, used to ride. The Prince also granted for his maintenance a free-gift of four villages, named Bokalur, Malway, Arasur, and Nullur, in the district of Trichinopoly, north of Coladam, yielding a net revenue of 12,000 Rupees per annum, and appointed him to the office of dewan. Whilst in that office he retained the habit of a religious devotee, and on his circuits assumed all the pomps and pageantry with which Hindoo *gurus* usually travel, along with the civil Mahomedan honours, such as chobdars, horsemen, drums, fifes, caparisoned state horses, hurcarrahs, daloyets, nowbut, tents, &c.

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* Vydenada Swamy called Vêloorân, the deity abovementioned under the appellation of Vineideerthan, is represented as afflicted with elephantiasis or an enlargement of one of his legs, his brother-in-law, Vishnu, with diabetes, and his son Pilliar or Ganesa with an enlarged stomach. The words here used have also a double meaning. Vadakkal is "Foot upon dispute," alluding to the attitude in which Siva disputed with Kali, dancing on one foot, as well as elephantiasis. Nirizhivu is "running of water," alluding to the Ganges flowing from Vishnu's foot, as well as the disease.

Although he was now engaged in state affairs, and continued his study of the Hindu sciences and the composition of several useful works, yet his principal efforts were then directed to the conversion of idolators, whilst he amused himself in the reading of Tiruvalluver Cural, Naladiar, Chintamani, Ramayanam, and other celebrated Hindoo works.

Viramamuni continued to hold the office of dewan in Trichinopoly, until the year 1740, when that city having been besieged by the Mahrattah army under Nather Sing, and Chunda Saib made prisoner, he proceeded to Manapar, and remained there in the service of the church.

But unfortunately a constitution much broken down by incessant study, and laborious travels in countries whose climates are so prejudicial to European constitutions, particularly to one who led such a life as he did, shortened his life; and consigned him to a world of better existence, where he is no doubt gone to receive the reward of a life well spent in the discharge of those duties, which devolved upon him as a man and a Christian. He died at Manapar in the year 1742.

When all the circumstances of his life are taken into consideration, many will be of opinion that such pomp as has been above described did not proceed from worldly motives. Although some of the Missionaries murmured against such proceedings, men of sense will at once perceive that the Jesuits did not display such worldly splendour to improve their income, or to enable them to support their families, for family they had none, and therefore no one can say that they took pains for such purposes, but purely with a view to get the people of this country to embrace the Christian religion. For this sole purpose then the Jesuits assumed the habit, &c., of the Hindoo priesthood, rejecting animal food to which they were accustomed from their infancy, and living on vegetables and other meagre diet, to which Europeans are not trained, that the cause of Christ may, even at the risk of their health, and other bodily discomforts, not meet with any obstacle on those scores.

The most valuable Missionary of the Society of Jesus, the Reverend Father Roberti Nobili, perceiving that the high caste people of this country had an aversion to the Christian religion, under an impression that in embracing it they would be lowered in the eyes of their heathen relatives, and the intercourse between them in consequence discontinued, and if discontinued nothing could equal such degradation, he, our Christian champion, spared no pains in discovering a method of removing such impression. He was so far fortunate as to find out that it consisted in the manner of living, and this among the Hindoos was of the most harmless and simple nature, and nowise inconsistent with Christian principles, inasmuch as it required only an innocent change by the Christian preacher of his habit and diet to that of the native priesthood. These, though not contrary to the principles of the gospel, yet being in a worldly point of view both unprofitable and prejudicial to health and comfort, were yet readily assumed by our divines, whereby they had the happiness of bringing over to Christianity, not only many men of high caste, but through their means whole Indian tribes. Under these circumstances it must be evident that the assumption of such habit, &c., was caused purely by an ardent desire of promoting the cause of Christianity, and not to obtain any worldly advantage.

As the Jesuits became thorough masters of the languages of the country, and the authors of admired compositions in it? they were therefore qualified to wear the costume of the priests of the country, and to preach with eloquence and persuasive effect, convincing and delighting the natives themselves in the language of the country. Moreover the books of the Jesuits are read by the Hindoos in general with pleasure, to this day, because they are so elegantly and skilfully adapted for inculcating and recommending the Christian religion.

What prevails as rank among Europeans, may in a manner be compared with the caste of the natives. However, there is a difference between rank and caste; because if any European of high rank associates and eats with a low man of his nation, the former cannot be degraded into or become a man of low rank, as the Europeans have never had any distinction of caste, either before or after they embraced Christianity. The natives are differently situated. If a Brahmin or other high caste native associates and eats with a low caste man of his country, the Brahmin will be considered as having become a low caste man, there being separate sorts of foods for the different castes of this country. There is no such difference in eatable things among people of high and low rank in Europe.

Although the natives do not associate, nor eat with the low caste people of their own country, yet they consider them as themselves with regard to spiritual concerns. The civil distinction of caste cannot therefore be contrary to the second great commandment of God, as it is not applicable to the associating, eating, &c., but refers to spiritual concerns alone. See 14 chapter, verse 17 of St. Paul's Epistle to the Romans, "For the kingdom of God is not meat and drink." In opposition to this Scripture it is asserted that, a Brahmin, Chatriya, Vaisya, or Sudra cannot become a true Christian unless he associates and eats with them the food served on their table, which has been dressed by Pariahs. Surely this is not in conformity with the Scripture of St. Paul. See verse 15, chapter 14 of St. Paul to the Romans, "But if thy brother be grieved with thy meat, now walkest thou not charitably. Destroy not him with thy meat, for whom Christ died."

If we relinquish the distinction of caste we shall be unable to marry the daughters of our heathen relatives, and we should be unable to indulge the hope of our heathen relations becoming converts to Christianity.

The Jesuits being acquainted with all the practices and customs, as above described, did not interfere with them as long as they were not in themselves sinful, nor connected with the heathenish ceremonies of the country. Yet they were very particular in preventing all sinful acts and superstitious ceremonies, by preaching and publishing numerous works, particularizing in them what might be retained and what ought to be rejected, and peremptorily prohibiting the observance of any thing contrary to Christianity.

In other respects they conformed entirely to the customs of the country, in which they lived, according to the example of St. Paul, 1st Cor. 9, 20. "To the Jews I became as a Jew that I might gain the Jews, &c." so the Jesuits assumed the title and appearance of Brahmins to gain the Brahmins. Moreover they abstained from the use of animal food, and lived on rice and vegetables according to the customs observed by the high caste people of this country, for they did not care to pamper their bodies. See St. Paul's 1st Epistle to the Corinthians, chapter 8, ver. 13. "Wherefore, if meat make my brother to offend, I will eat no flesh while the world standeth, lest I make my brother to offend."

Appendix No. 1—*Specimen of Father* Beschi's *Poem, quoted by Mr.* Ellis *in his translation of the Cural; together with some few additional translations of the same poem from my late publication entitled the Padigam.*

ON THE ATTRIBUTES OF GOD.

Vide Ellis's Cural, page 23.

Vira-mamuni, by which title the Rev. C. J. Beschi is best known as a Tamil author, in the 27th book, குருபகப்படலம், of his epic poem the Tembavani, commencing with the 156th and ending with the 163d verse, introduces Joseph, the husband of St. Mary, explaining the attributes of the Deity: of these I shall quote only the two first, as the remaining six contain merely the separate illustration of each attribute, of which a shorter and, therefore, more perspicuous explanation will be given from another work. To each verse of this poem the author has added a prosaic gloss, frequently expanding into a comment, from which, as affording a fuller view of the subject than the text, the translation is made.

ஈறிலநன்மைநிறைவுமோர்குறைமுற்
றின்மையுந்தொழத்தகுந்தெய்வ
மாறிலவியல்பேவேரிதாய்க்கிளைத்து
வரும்பலவினையெனநூலோர்
ஆறிலக்கணங்களுரைத்தவையுள்ளோ
ருண்டகையிலனலனென்றார்
தாறிலகடாமைவரித்தன்ன
சாற்றுறும்புன்சொலாலவையே.

மட்டின்றியெல்லா நன்மைநிறைவு மெல்லாக் குறையின்மையு மென்றிவ்விரண்டேயெவரும் வணங்கத்தகு மெய்க்கடவுட்குரிய மாறாதகுணந்தாமே - இதுவேராகக்கொண்டு கிளைத்தபலகொம்புக ளின்றன்மையாவிக்குணத்தைவிரித்து நூலோர் மெய்யானதேவனை யறிவதற்காறிலக்கணங்களைச்சொல்லி யவையெலாமுடையோன் றேவனேயென்று ரவற்றுளொன்றாயினுங்குறைந் தெல்லாவற்றையு மில்லாதவன்றேவனல்லனென்றார் ஆகையாலவ்விறத்தகநிருள னாரி யனைமையாலெழுதினாற்போல நானுமென்புன்சொல்லாலத்தேவா றிலக்கணங்களைச்சொல்லிக் காட்டுவேனென்றான் சூசையென்க.

தன்வயத்தாதன்முதலிலனாதல்
தரும்பொறியுருவிலனாதல்
மன்வயத்தெல்லாநலமுளதாதல்
வயின்றொறும்வியாபகனாதல்
பின்வயத்தின்றியொருங்குடனைத்தும்

பிறப்பித்தகாரணனாதல்
பொன்வயத்தோளிர்வான்முதலெலாவுலகும்
போற்றுமெய்யிறைமையினிலையே.

தன்னாலாதலுந் தொடக்கமின்றியாதலுமைம்பொறிக்குரியவுருவிலனாதலு நிலைபெற்றசகலநன்மையுளனாதலு மெங்கும்வியாபகனாதலுந் தன்னையல்லாதோருதவியின்றி யெல்லாவற்றையு மொருங்குடன்படைத்த வாதிகாரணனாதலு மென்றிவ்வாறிலக்கணங்கள் பொன்னொளிர்வானுலகுமுதலெவ்வுலகும் வணங்கத்தகுமெய்க்கடவுளின் றேவதத்துவமிதேயென்றானென்க.

Infinite goodness extending to all and the absolute deprivation of all defect, these two are the appropriate and unvarying attributes of the true God, worthy to be adored by all. From this root the six attributes by which the wise have endeavoured to convey a knowledge of the true God have arisen like branches; they say that he who possesses all these is God, but that he who is deficient in one must, also, be deficient in the rest and, consequently, not God. Therefore, said Joseph, even as they attempt to depict in ink the sun with unnumbered beams, will I in language all inadequate endeavour to explain the six attributes of the Deity.

Existing by himself; existing without beginning; existing independently of the organs of sense; being possessed of everlasting and universal goodness; pervading all space; being the first cause by which all things were created at once and without assistance:—these six attributes describe the divine nature of the true God, worthy to be adored in the heavens, shining like gold, and in all worlds.

These *six* attributes, expressed in the same terms, are, also, found under the word குணம்-க in the Togei-yagaradi or third division of Vira-mamuni's Sadur-agaradi, or dictionary of the high Tamil in four parts, and they are, also, enumerated in the commentary on the following couplet, which contains the invocation prefixed to the part treating on prosody in his grammar of the high Tamil, entitled Tonnul-Vilaccam.

யாப்புறநலமெலாமிணைந்தவோர்சட்குணன்
காப்புறவடிதொழீஇச்சாட்டுதும்யாப்பே.

Having, to obtain his aid, worshipped the feet of the only God, who united with all good, possesseth the six attributes, I proceed to explain the rules of prosody.

PRAISE OF GOD.

As a further exemplification of the success with which Vira-mamuni has imitated, not merely the expression, but the modes of thought of the previous Tamil writers, the following stanzas are selected from the

Tembavani. In the poem which is added, though by no means intended to emulate this author in perfection of language, a similar imitation of the style of these writers has been attempted; with what success the reader will judge—

அறக்கடனீயேயருட்கடனீயே
யருங்கருணாகரனீயே
திறக்கடனீயேதிருக்கடனீயே
திருந்துளமொளிபடஞான
நிறக்கடனீயேநிகர்கடந்துலகின்
னிலையுநீயுயிருநீநிலைநான்
பெறக்கடனீயேதாயுநீயெனக்குப்
பிதாவுநீயனைத்துநீயன்றே.
கார்த்திரன்மறையாக்கடலினுண்மூழ்காக்
கடையிலாதொளிர்பரஞ்சுடரோ
நீர்த்திரன்சுருட்டிமாறலையின்றி
நிலைபெறுஞ்செல்வநற்கடலே
போர்த்திரன்பொருதக்கதுவிடாவரணே
பூவனந்தாங்கியபொறையே
ஞர்த்திரள்பயக்குநோய்த்திரள்துடைத்துத்
துகடுடைத்துயிர்தரும்முதே.

Thou art the sea of virtue, thou art the sea of grace, thou art the most benevolent,

Thou art the sea of power, thou art the sea of prosperity, thou art the sea of wisdom which enlighteneth the mind;

Thou art the confirmation and the life of the world, to whom is no likeness;

Thou art the sea by which I am confirmed, thou art to me as a mother and father; art thou not all to me?

Thou art the infinitely bright and heavenly sun, which cannot be hidden by the assembled clouds and which sinketh not into the ocean;

Thou art the sea of constant felicity which hath neither swell nor wave;

Thou art an impregnable castle which no foe hath ever taken; thou art the mountain which supporteth the earth;

Thou art the life-giving nectar which cureth all distemper, allayeth all pain and removeth all defect.

தேறந்தயையின்முனிவோய்நீசினத்திற்கருள்செய்கனிவோய்நீ
கூறுங்கலையற்றுணர்வோய்நீகூறுந்தொனியற்றுரைப்போய்நீ
மாறும்பொருள்யாவினுநின்றேமாறுநிலைகொன்மரபோய்நீ [யோ.
யீறந்தவிர்த்துன் புகழ்க்கடலாழ்ந் தெனக்கேகரைகாட் டருளா
ஒளிநாக்கொடுவான்சுடர்புகழவொளிநாக்கொடுபன்மணிபுகழக்
களிநாக்கொடுபற்புள்புகழக்கமழ்நாக்கொடுகாமலர்புகழத்
தெளிநாக்கொடுநீர்ப்புனல்புகழத்தினமேபுகழப்படுவோய்நீ
அளிநாக்கொடுநானுனைப்புகழவறியாமூகையுணர்த்தாயோ.

O thou who in thy protecting kindness art angry and in anger delighteth in mercy !

O thou who without instruction knowest all things and sayest all things without a voice !

O thou who in the midst of all things changeable art by thy nature unchangeable !

Wilt thou not vouchsafe to shew the shore to me who am sunk in the everlasting ocean of thy praise ?

The resplendent beings of heaven praise thee by their tongues of light;

The various birds praise thee by the tongue of joy; the flowers of the grove praise thee by the tongue of fragrance;

The waters praise thee by the tongue of transparency, O thou who art praised for ever!

Wilt thou not teach me, the ignorant and the dumb, to praise thee by the tongue of love ?

மருடருவலியுருவே மருளறுசினவுருவே
யருடருதயையுருவே யளவறுதிருவுருவே
தெருடருகலையுருவே செயிரறுமனுவுருவே
பொருடருமணியுருவே பொழிமணவடிதொழுதேன்.
உரையிலகலைநிலையே யுயரறமடையுரையே
கரையிலபடர்கடலே கதியுயிர்பெறுகரையே
வரையிலசுகநிலையே வளர்தவமடைவரையே
புரையிலமனுமகனே புதிமலரடிதொழுதேன்.
மருமலிமலர்நிழலே மறைமலியுயர்பயனே
திருமலிகரமுகிலே சிவமலிதனிமுதலே
யிருமலியுலகுளரோ பிணொடுதொழுமடியே
குருமலியறநெறியே கொழுமலரடிதொழுதேன்.

O thou who hast the power to cause dread, but art not disturbed by thine anger! O thou by whose mercy grace is vouchsafed and unnum-

bered blessings are conferred! O thou who art the knowledge which giveth understanding, who in the human form destroyedst sin! who art a precious jewel set in gold! I worship thy feet diffusing fragrance.

O thou who possesseth knowledge not conveyed by words and art the word by which the highest virtue is conferred! O thou who art a broad ocean without a shore and the shore attained by beatified spirits! O thou who art eternal happiness without limit and the limit to be attained only by unceasing devotion! O thou, the Son of man without an equal, I worship the newly blown flower of thy feet!

O thou whose protecting grace resembleth the shade of fragrant flowers, who art the exalted sense of the scripture, whose hand, bounteous as the clouds, dispenseth felicity, who art alone the cause of salvation, whose feet those dwelling in the two worlds adore and adorn with flowers, who art both the teacher and the path of virtue, I worship the blooming flower of thy feet!

THE DESCRIPTION OF THE COUNTRY OF JUDEA.

*On the Cloud and Rain.**

புள்ளுலாம்விசும்பிடைதொறும்பொரும்படைபொருவ
வெள்ளுலாமழைவெண்கொடியுருக்கொடுவிளங்கித்
தெள்ளுலாந்திரைதிளைப்பவுண்டெழுந்துயர்பரந்து
வள்ளுலாங்கருமதகரியினமெனத்தோன்ற.
போர்புறங்கொடுபொருந்தலருரத்திறேய்த்தொளிர்வேற்
சீர்புறங்கொடுதிசைதொறுமிருளறமின்னி
வார்புறங்கொடுவளர்முரசொலியெனவதிர்த்து
நீர்புறங்கொடுநீன்முகின்முழங்கினமாதோ.
படையெனச்செருப்பகைதரப்படர்ந்தனவல்லாற்
கடையெனச்செறிகருணையோடுஞற்றியவள்ளற்
கொடையெனச்செழுங்குன்றொடுவயின்றொறுங்குளிர
மிடையெனச்சொரிவியன்முகில்வரைவில்பொழிய.

As in an army arrayed for battle, over all the sky, where the birds rove, white clouds appear resembling white banners; but, having filled themselves with the clear waves of the ocean, they spread abroad and seem like a mighty herd of black and furious elephants.

Like bright spears glancing from the breasts of enemies in the field

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* It is an invariable rule in the Tamil language, after the invocation, and the statement of the subject, to open a poem with a description of the hero's country, and of the capital where he is supposed to have reigned or flourished; and these are represented in the most favourable colours; not such as they are believed to have been, but such as the poet chooses to describe them. In this description, the rains which descend in the mountains, the streams which flow from them, and the consequent fertility of the country, never fail to have their place. Vide page 112, Shen Tamil Grammar.

of battle, they darted their lightnings dissipating darkness in every quarter and, trembling as it were by the reverberating sound of leather-bound cymbols, the black and watery clouds thundered aloud.

Though at first taking the appearance of an army prepared for horrid battle, at length, as the liberal minded bestow their gifts, diffusing coldness over the mountains and the whole expanse of the earth, the extended clouds poured down abundant rain.

ON THE STREAMS.

படித்தநூல்வையபயன்படவிரித்துரைப்பவர்போ
றடித்தநீன்முகிறவழ்தலைப்பொலிந்தபொன்மலையே
குடித்தநீரொலாங் கொப்புளித்தமுதெனவருவி
பிடித்தருவொலியெழுந்திரையெறிந்துருண்டிரிய.
அஞ்சிலாவெதிரடுக்கியகல்லெலாங்கடந்தே
எஞ்சிலாவெழிலமைத்தநீண்மருதமுநீக்கித்
துஞ்சிலாநதிதொடர்ந்தகல்கருங்கடனோக்கல்
விஞ்சையாரொலாம்வெறுத்துவீடுவறியபோன்றே.

From Padigam.

நிறைதவிர்த்துணர்ந்தகாமநெறியிற்கைப்பொருளேபோன்றும்
முறைதவிர்த்தடைசேர்போன்றும்முனிகடம்முனிவுபோன்றும்
பொறைதவிர்த்திழிந்தீண்டோடும்புன்னல்மெதிர்கொண்டாங்கத்
துறைதவிர்த்திடத்திட்டேகித்துளித்ததேன்முல்லைசேர்ந்தார்.
பொய்செலச்செல்லும்வாயிற்பொலிவொடுபெருகும்போல
மைசெலச்செல்லும்வாரிமருளிவத்தளவிற்பொங்கி
மெய்செலச்செல்லும்நன்றேத்தெங்கணும்விளைவுய்த்தோடிப்
பைசெலச்செல்லும்நாகப்பரிசெனச்செல்லுமாறே.

Like these, who, for the benefit of others, teach the learning they have acquired, the mountains abounding in gold, whose summits are embraced by the clouds, cast forth all the water they had imbibed and the nectarean stream, murmuring incessantly, rolled on its swelling waves.

The streams passed boldly all the rocks that opposed their passage and, leaving the far-extended tract of cultivated land, bright with exhaustless wealth, without stay flowed towards the azure ocean; as the wise, who, renounciug all, aspire alone to obtain heaven.

The following two streams of the rivers are said to have been crossed by the holy family on their journey from Bethlehem to Jerusalem; and from Jerusalem to Egypt.

They (the holy family) met with a stream which descends from the mountains as speedily as the anger of the holy men is appeased—or, with velocity similar to that with which the wealth of those, who, having forsaken that which is right, abandon themselves to unlawful desires, is dissipated;—or, to that with which unlawfully-acquired gains are consum-

*ed,—and having crossed the current and turned to the right, they arrived at the land of * Mullei flowing with honey.*

The river pursued its course, increasing in its progress by supplies from different streams swollen by the rains discharged from the passing teeming clouds,—as lies are exaggerated by different fabricators who happen to communicate them in succession,—entering the different vegetable creations,—like truth which carries happy effects in its progress, and winding like a hooded serpent coming on its way.

OPERATION OF CULTIVATION.

From Padigam.

செறியுலாம்புனல்சிறைசெய்துபயன்படவொதுக்கி
வெறியுலாமலர்மிடைந்தகல்வயல்வழிவிடுவார்
பொறியுலாம்வழிபோக்கிலதியல்படவடக்கி
நெறியுலாவறநேரவைநிறுத்தினர்போன்றே.
உவர்க்குந்தாழ்கடலுடுத்தகல்விரிதலைஞால
மெவர்க்குந்தாயெனவெண்ணிலாக்கிழிப்படக்கீறு
மவர்க்குந்தானுண்வளித்தலேநோய்செய்வார்க்குதவி
தவர்க்குந்தாவருந்தரும்மென்றியற்றுதல்போன்றே.
கூர்விளைத்தருட்குருவிதிபோன்றென்றுகோடி
நீர்விளைத்தநெல்திரம்பெனவித்தினரிரட்ட
வேர்விளைத்தபற்கடைசியர்குரவையாடியல்பாற்
றேர்விளைத்தவோர்சிறப்பெழும்விழாவணிபோன்றே.
நோக்கவின்புனநுகரவொண்முளரியோடாம்ப
னீக்கலாதெலாநீர்மலர்களையெனக்கட்ட
லாக்கமாக்கினுமறனிழந்தாவதுகேடென்
றாக்கமாண்பினொருங்கவையொழிக்குதல்போன்றே.
பூரியார்திருப்போறலைபசியகூழ்நிறுவி
நீரினூர்தலைநேரநேர்வளைவொடுபெழுந்த
வாரமானுநெல்லறுத்தரிகொண்டுபோயங்கட்
போரிதாமெனக்களித்தனர்போர்பல்புனைவார்.
மெய்கலத்தபொய்விலக்கிமெய்கொள்பவர்வினைபோல்
வைகலத்தநெல்பகட்டினூற்றெழித்துவைமறுத்துக்
கைகலந்தடுத்தேற்குநர்க்களித்தபின்களித்துத்
துய்கலத்தநெல்லுண்கவுமீகவுந்தொகுப்பார்.

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* Land in India is divided into five kinds, 1st குறிஞ்சி (Kuringee) mountain or mountainous land. 2nd பாலை (Palei) parched or desert land without water. 3rd முல்லை (Mullei) forest or pasture and shrubby land. 4th மருதம் (Marudam) well watered or wet land, fitted for cultivation. 5th நெய்தல் (Neydal) maritime land, [illegible] bordering on the sea.

In the Tamil grammars are described the different tribes of men, the different species of animals, birds, trees, flowers, and produce, &c., peculiar to each kind of the said lands.

THE HUSBANDMEN ARRESTING THE STREAMS.

The people arresting the full stream and turning it to advantage, conducted it to the broad field, abounding in fragrant flowers; as, restraining the five organs of sense from their own ways, the wise confine them to path of virtue.

Ploughing.

The extensive earth girt by the deep and salt ocean, supplies with aliment even these ungrateful children who tear and rend her bosom and thus performs an act of charity which is rare even among the penitents who do good to those that hurt them.

Sowing.

The doctrine inculcated by a merciful priest is promulgated after the fashion of the song sung by sowers accompanied with the dancing of the pretty village girls resembling the car drawn festival, viz.—may a grain of paddy nourished by water produce hundred millions of grains.

Weeding.

As the lotus, lily and other water flowers, though beautiful to behold are plucked out as weeds, so sages eschew matters, though productive of benefit, if not virtuous.

Reaping.

The green corn erects its new born stem like the mean suddenly possessed of wealth, but bends its full and ripened head like men of real merit. The husbandmen having cut the sheaves of paddy resembling pearls, collects them into heaps.

Sorting.

Like those who embrace truth avoiding the lies which are mingled with it, husbandmen separate the paddy from the straw by buffaloes, and store up the pure grains, partly for their own livelihood, and partly for the poor who wait for charity.

This is the translation of a choriambic stanza by Vira-mamuni, which, though professedly describing Italy, is entirely in the manner of the Tamil poets and in every respect appropriate to their climate; it forms the example for the construction of the species of verse called calippa, in the fourth part of the Tonnul, *on Prosody.*

(வெண்கலிப்பா.)

சென்றுகநீர்பொழியச்செல்வநிலைக்கறமுமிகப்
பொன்றுகநீர்புனையப்புவனமெல்லாம்புரந்தாண்டே
கருமேவும்வளைதவழுங்கமழ்வயற்பாய்பூந்தடஞ்சூழ்
மருமேவுநிழற்சோலைமயின்மேவிக்களித்தாடக்
கரும்பொப்பச்செஞ்சாலி காய்த்தலர்க்கைக்கடைச்சியரோ

சுரும்பொப்பச்சூழிரப்போர்துதித்துவப்பவீந்தீந்து
மாலைதாழ்குழலசையமணக்குரவையொலித்தாட
ஆலைதாழ்புனலொழுகியலர்வனமுங்கனிபொழிலும்
மல்கிவளர்சிறப்போங்கவளையாச்சீர்மனம்வெறுப்ப
நல்கிவளர்த்தலநன்று.

Here pour the waters from the clouds of heaven,
Diffusing wealth and virtue through the land,
Whose wide dominion, like the ambient sky,
Spread its protecting influence o'er the earth.
To fragrant fields, where creeps the pregnant conch,
From flowery lakes the full stream flows; the while
The peafowl dances neath the verdant shade
Of sweetly scented groves. The ripened rice
Overtops the cane and flowery-fingered girls
With liberal hand to all the poor, who swarm
Like bees around, distribute many a sheaf,
And, while their hair by odorous wreaths adorned
Floats loosely in the breeze, join in the dance
As at a marriage feast, their nimble feet
Accordant to their sounding hands. And here
The luscious juice flows from the cane compressed;
Unnumbered flowerets scent the ambient air;
Unnumbered trees their racy fruits afford.
The various produce of the plenteous field
And boundless wealth that satiates the mind,
Thus yieldeth Italy, delightful land!

On Devotees of the Christian Religion.

The Hindus, however, among whom it originated, have carried their ideas of the "Divine Philosophy" farther than others, as they require, not merely the relinquishment of every selfish attachment, but the utter annihilation of self: even this is not considered by Viramamuni, as inconsistent with doctrines of his own Church, as the following extracts, in which occur the every expressions used in the last quotation, will evince.

பவமேபழித்துப்பூவனத்திற்படர்ந்தவணங்கிற்றுயிர்காத்துத்
துவமேநயனைப்பயத்துய்க்குந் துணையேதென்னின்மன்னுயிர்க்கெங்
கவமேதுயர்செய்நானெனதென்றுயவிருபற்றினிதறுக்குந்
தவமேயுயிர்க்கோர்துணையென்றுன்றவத்தின்பவ்வக்கலைகண்டான்

மெய்த்துணையிழுக்கெனத்துறவின்மேன்மையோர்
பொய்த்துணையென்றுதம்பொறிகள்போழ்குவா
ரத்துணைக்கடிந்தபின்னனையர்மற்றிவ
ணெத்துணைக்கொள்பவரென்னவோதுநீர்.
தான்றனதென்றிருதகுதிப்பற்றறு
நோன்றனவடற்கொடுநோக்கிவானுயர்
கோன்றனதருணிலைசார்ந்தகொள்கையி
லான்றனமதுகைமூவுலகுமாட்டுமே.

When the means are sought by which, forsaking sin, the soul may be protected from the evils spread through the world and everlasting happiness may be obtained; it will be found that devotion, by cutting off the two affections, expressed by the terms I and MINE, *by which immortal souls are here vainly disturbed, is the sole cause of their salvation: thus said Joseph, who had beheld the shore of the ocean of devotion.*

Those who have attained the eminence of devotion and, despising, as illusive, the aid of the body, have annihilated their sensitive organs; after they have thus rejected with disgust corporeal aid, say what further aid they require in this world?

His power, who by the force of devotion has annihilated the two affections, expressed by the terms HIMSELF *and* HIS OWN, *supported by the protecting grace of the most High, the King of heaven, is sufficient to shake the three worlds.*

The first of the succeeding verses is an amplification of the thought in the former part of this couplet, the author having judiciously avoided the incongruous figure with which it concludes. This extract is from the thirtieth canto (Meetchi padalam) of the Tembavani; in which, while the holy family are crossing the desert, on their return from Egypt, the Saviour is represented as enumerating in prophecy the several devotees, who in succeeding times are there to devote themselves to austerities and by their example to introduce monastic discipline into the Church. The primitive ascetics Paul, Anthony and Hilarion are first mentioned, but of the many names that follow few can be recognized, as they are either translated into Tamil or altered so as to conform to the orthography of that language. *Ejesia Mariyal,* celebrated in the concluding verses of the extract is St. Mary the Egyptian, the first female recluse on record in the Christian Church: she was discovered by St. Zosimus in the desert beyond Jordan, where she had passed forty-seven years in the simple attire to which the poet with such delicacy alludes.

அவாவெனமதத்தின்சீற்றத்தறிவெனப்பாகன்வீழ்ந்த
வவாவெனவுடலைக்கைக்கொண்டிக்கநற்றோட்டிமாற்றி
யிவாவனதவக்கவட்டைடயிட்டிருவிரதத்தூணின்
மவாவனமுனிவன்சேர்த்திவானமும்வியவச்செய்வான்.
வீட்டருநாட்டிற்கேற்றவிழுட்பொருளாகநாடி
யீட்டருஞ்சீலக்குப்பையேற்றிநல்லுயிரோடியாக்கைப்
பூட்டருமேராய்ப்பூட்டிப்புரைநசைச்சேற்றுட்செல்லா
வாட்டருந்தவத்தின்பண்டிமதித்தகன்கதியிற்சேர்ப்பான்.
தேனிமிர்முல்லையாகத்திருந்தறத்தொகுதிநட்டு
நாளிமிர்தவத்திற்காத்தஃதொறிற்பொறிவேலிகோலி
மேனிமிரொழுக்கநீரைவிட்டருண்மணலைப்பாய்த்தி
வானிமிருலகுறும்வனத்திலுங்கசோரன்பூப்பான்.
ஆற்றியதவச்செந்தியிலைம்பொறியிரும்பிட்டூதி
யேற்றியதெருளின்ஞானவிரதமிட்டாயபைம்பொன்
றேற்றியமறையர்சாகச்சிலநன்மணிகள்சேர்த்திப்
போற்றியதேவமார்பிற்புரோதரனணிப்பூணுவான்.
தீயவுநலவுமுள்ளிற்றேறியபெண்ணிற்றேற
லாயவுமரிதேமுன்னாரழிந்தநாள்வேவிதாவி
யேயவுங்காமத்தாழ்ந்தவெசிசியமரியாள்பின்னர்
தூயவுமரிதிலோர்ந்துதுறந்திவணெருநாணிற்பாள்.
கண்மையின்மற்றியாருங்கண்டதன்பிழைகாண்பாரார்
நுண்மையினுற்றபாவநுதவியுட்டானேகண்ட
வுண்மையினுணர்ந்தழுக்கமுளத்திறகாகவெப்திப் [ள்.
பெண்மையின்போர்வைநாணம்பிரிவிலள்போர்த்துநோற்பா
காமமேபறவைத்தேர்மேற்கசடெனும்பாலைசேர்ந்தாள்
வீமமேபறவைத்தேர்மேல்வினைதவக்குறிஞ்சிஞான
வாமமேபறவைத்தேர்மேல்வளரறமுல்லைசேர்ந்தென்
றூமமேபறவைதேர்மேனயபபவாறூட்டைச்சேர்வாள்.

When by the outragious fury, of the passions the driver had fallen from his seat, Mavavana muni, having seized and mounted the elephant, which is the body; governing him by the strong hook of resolution, he will bind him to the pillar of constancy by the rope of penance, and fill all heaven with admiration.

Desirous of obtaining the wealth peculiar to the kingdom of heaven, Madittagen having heaped on the car of unceasing penitence a load of holiness and yoked to it, as oxen, his body and soul, avoiding the quagmire of sinful desire, he will arrive at salvation.

Having planted the honey-dropping jasmin-vine of perfect virtue; having surrounded it with a hedge of subdued senses, to protect it by *penance supported by religion; having let in the water of strict discipline and spread around it the sand of grace, Asoren will flourish as a garden whose fragrance reacheth to heaven.*

Blowing the red furnance of penance and placing therein the iron of the five senses, adding the mercury of bright wisdom, Purodaren poured the pure gold thus obtained into the mould of religion and, having enchased it with precious jewels of virtue, he became an ornament for the breast of the God he adored.

Though women may inwardly resolve on good or bad it is difficult for them to persist in their resolution; thus, though the Egyptian Mary, overleaping the fence of modesty, had at first plunged into the sea of carnal desire, yet at last, having determined to perform austerities with the purest devotion, she will retire from the world and long remain here.

The eye perceives not the colour by which it is darkened, and who are they who see their own faults apparent to all others? but she remembering of herself her minutest sins and borne on the wings of mental resolution, produced by reflecting on the truth she perceived, gave herself up to devotion covered only by the mantel of female modesty.

On the flying chariot of desire she arrived at the desert of sin; on the flying chariot of fear she repaired to the mountains of penitence; on the flying chariot of resplendent wisdom she entered the grove of growing virtue; and on the flying chariot of my name she shall enter the kingdom of heaven.

விடுறவேண்டினீவித்தித்தநால்லாற்
காடுறவொளிக்குதல்கயங்குளிக்குதல்
நீடுறவிழுர்சடைநீட்டன்மற்றவை
யீடுறப்பயனிலாவெளிறிதாமென்பார்.
சடைவளருருக்கொடுதவிர்கினீர்குளித்
தடைவளர்வனத்திடையகன்றிலாத்திரிந்
திடைவளர்கனிகளோடிளங்கிழங்குணும்
முடைவளர்சரடிகள்முனிவரோவென்பார்.
சுரத்திடைத்தழலொடுதுறும்புருக்களு
மரத்திடைத்தூங்கிநற்கனியுண்வாவலு
முரத்திடைத்துறவரோவுளத்தின்மாண்பலாற்
பரத்திடைக்கிளர்வினைபரியுமோவென்பார்.
செம்பொறிச்சினத்தபோர்ச்செறுநர்க்கஞ்சலாற்
பைம்பொறியெயிலின்வாய்ப்படியப்பூட்டியுள்
வெம்பொறியெழுத்தமைவெட்டிவீழ்த்தெனு
வைம்பொறியடக்கியுள்வவாக்கொண்டாலென்பார்.

On the false Devotees.

If, said the devotees, everlasting happiness be desired, it may be obtained by the rule thou hast propounded and not by seclusion in the wilderness, bathing in fountains, or cherishing long locks of tangled hair, for these and similar acts cannot produce eminent virtue; all this is utter ignorance.

Will they call the rank bears devotees because their bodies nourish tangled hair and they fail not to bathe in water, or because they unceasingly wander through the leafy woods, or because they feed on the fruits and tender roots therein produced?

Will they call the doves that rove amid the heat of the parched desert, or the bats hanging from the trees and feeding on their choicest fruit, the greatest of devotees; how without purity of mind can the sins formerly committed be cleared away?

As one, who, after having firmly fastened the gates of the threatening battlements, from fear of an invading enemy enflamed by rage, urged by his own innate fury stabs himself and dies; so is he, who, although he restrains the five outward organs of sense, is ruled by inward passion.

A Controversy between the Domestic Life and Retirement.

In the fourth canto of the Tembavani (Pālamātchi padalam), Viramamuni introduces a controversy between the youthful Joseph, who, desirous of leading a life of devotion, had retired to wilderness, and an Angel in the form of an old-man, on the relative merits of seclusion and social life: from this the following extract is taken.

நாடொறுங்கனிந்தசெந்தேனற்கனியளித்தனன்றே
கோடுறுமரமுந்தன்னைக்கொடுத்தலேநன்றேவிவ்வா
நீடுறுமுளனுமுன்றூம்தல்செய்துறவேயென்பார்
வீடுறுநாலோரொன்னவிளம்பினானிளவல்மாதோ.
காயொடுமரந்தந்தாற்போற்கடித்துறவருமைவெஃகி
வேயொடுநெருங்குங்கானில்விழைந்துதானொழுகனன்றே
தீயொடுகுழைமற்றேருஞ்செவ்வுறச்செலுத்தனன்றே
தூயுடுவுணர்வோயென்னச்சொற்றினான்குரவனம்மா.
பெற்றறமணிந்தநல்லோய்பிறர்மனைவிளைத்தசெந்தீ
யற்றறவோடித்தன்வீடழுன்றதேபோலவேட்கைப்
பற்றறவுணர்த்தியுள்ளம்பற்றியநசையில்வெந்தா
விற்றறவுறுதியென்னோவென்றன்னரியருசை.
தீதிலாவிடமேவேண்டிற்சேணுலகெய்தல்வேண்டுங்
கோதிலாவனத்துந்தன்னைக் கொணர்ந்தகால்விலையும்வெம்போ

ரோதிலாதொழுகலுள்ளத்தியல்பினூலாகுமன்றி
வாதிலாவிடத்தாலாகாமைந்தனேயென்றான்சான்றோன்.

" Is it preferable to present daily the honey-dropping fruits, or to offer at once the tree with all its branches ?" for, said the youth, "the learned say that for the devotee to offer himself and all that he possesseth is perfect devotion."

" O thou who art possessed of pure knowledge" said the old man, " whether is it preferable that a man, offering, as it were, the tree with all its fruits, should dwell alone in the wilderness, choaked with bamboos, and attached only to the practice af austere penance, or that he should conduct others involved in sin, in the right path ?"

" O excellent man who art adorned by virtue," said the eminent Joseph, " is it right, that, while a man is instructing others to assuage the fire of passion he himself should be exposed to be consumed by it, like a man whose own house is burned while he runs to quench the flames which have caught his neighbour's house ?"

" If thou art desirous of being where no sin is, thou must seek that place in heaven; even when retired to the wilderness, the asylum of innocence, the war of the passions may still rage; freedom from sin proceeds from strength of mind, not from difference of place, O my son !" replied the Sage.

The argument is thus continued through many stanzas, the disguised Angel maintaining the superiority of domestic virtues and the youthful Saint extolling the virtue of retirement. It concludes with the following verses.

பாற்கலந்திட்டதெண்ணீர்பால்குன்றும்பண்புமில்லாக்
மேற்கலந்தொளிர்ந்தவெய்யோன்வெயிலுமுன்னெரித்ததீபம்
போற்கலந்திசைத்தமற்றைப்புண்ணியந்துறவுவாய்ந்த
சாற்கலந்தியல்பையேற்றுந்தகுதியோவென்றான்பாலன்.
தெருட்டகுமுணர்விற்சான்றோன்சேடனைத்தழுவிச்சொல்வா
னருட்டகுமுணர்வன்பூக்கமரும்பொறையீகைமற்ற
மருட்டகுமியல்தீர்மாட்சிமதியைமீன்சூழ்ந்ததேபோற்
பொருட்டகுநாட்டில்வைகும்பொலந்துறவணியுமன்றே.

" Like milk mixed with water, which by diluting it decreases its natual properties, or like a lamp burning before the beams of the bright-rayed sun shining on high," said the youth, " are all other virtues, which in truth are only sound, and can these, therefore, add any thing to the high eminence acquired by devotion ?"

The Sage of lucid intellect tenderly embracing the youth said; "As the stars surround the moon, may not benevolence, knowledge, affection, constancy, forbearance, liberality and other unillusive virtues adorn devotion though it be practised in a country abounding in every species of wealth."

To those who remember the scope of the controversy between the Jansenists and the Jesuits, though this, like other phantasies of the same kind, is fast fading from human cognizance, the following quotation will not be unpleasing: it is curious, also, as a specimen of the dexterity with which the author seizes every handle offered him, if it seem likely to become a useful instrument in the prosecution of his labours, and of the sophistical, but characteristic, ingenuity, with which he endeavours to reconcile doctrines in reality incompatible. The terms தலைவிதி *the destiny of the head,* and தலையெழுத்து *the writing of the head,* used in this extract belong properly to mythology, which feigns, that, previously to birth, the destiny of every individual is written by Brahma in the head of the embryo; this writing, it is supposed, is seen in the indented line which marks the sutures of the skull.—See the 27th canto (ஞாபகப்படலம்) of the Tembávani; the controversy here detailed between Sivasiven, who supports the character of a Hindu guru, and Joseph, commences with the doctrine of the metempsychosis, from which it naturally deviates to the subject of destiny and the origin of good and evil.

கூறியவிந்நிலையுளதேற்குன்றுடனு
  முடல்வனப்புங்குறையும்வாழ்வும்
மாறியவிந்நிலையுலகில்வழங்கியகா
  ணீதியிதோவழுவோகூறாய்
தேறியவிந்நிலைமிக்கோயென்றுசிவா
  சிவன்கேட்பத்தெளிந்தவார்வத்
தூறியவிந்நிலைமதுச்சொற்பூங்கொடியோ
  னுரிமறைநூலுரைத்தான்மீண்டே.
ஆதியிலாவீறுமிலாவினையின்றி
  யென்றுமுளோன்மல்லொன்றே
பேதியிலாவான்வருமெம்முயிரும்
  படைப்புண்டபின்னீறில்லா
வோதியிலாமற்றுயிர்கள்முதலீறன்
  ளன்வென்னவுரிநூலீதாய்
நீதியிலாநவையுறுமுன்முதற்படைப்பெம்
  முயிர்கொண்டநிலைமையென்றே.

பார்முகத்துமுதலுடல்புக்கெம்முயிர்க
டோன்றியகாற்பரிவற்றெல்லாச்
சீர்முகத்துவாழரசாயாவருங்கொல்
பன்முகத்துச்சென்றாரென்னிற்
பேர்முகத்துவயத்திறையோனீதியதோ
நீதியதேற்பிறழாநீதி
யோர்முகத்துமுன்வினைகளின்றிபின்று
மிவ்விகிர்தமுள்தாமென்றான்.
முற்பிறப்பின்விடங்கமுறத்தலைவிதி
காரணமென்றான்முன்பானீதி
தற்பிறப்பினன்புயர்ந்தோன்வேறுபட
விதியெழுதுத்தயவேதென்னச்
சொற்பிறப்பினடங்காதான்றிருவுளமே
யெனவன்றானாசைமீண்டே
பிற்பிறப்பின்வீற்றியற்றுத்திருவுளமுந்
தானென்றாற்பிழையோவென்றான்.
தெருட்செல்வமிக்கிறையோன்முட்டிலத்தும்
பெய்முகிற்போற்சித்திப்பெய்த
பொருட்செல்வம்வறிதென்னப்பூரியர்க்குஞ்
சால்பிறைப்பான்பொருவாமாட்சி
யருட்செல்வநசைக்களவாயாவருங்கைக்
கொண்டோங்கவயமேதந்தான்
மருட்செல்வமற்றெவையுமாகியது
வறப்பயனோமதியின்மிக்கோய்.
சலத்தெல்லாமோர்நிலையோதருக்கெல்லா
மோர்கனியோதரணியெங்கு
நிலத்தெல்லாமோர்வினைவோநமக்கெல்லா
மோர்முகமோநிலையும்பல்லாய்க்
குலத்தெல்லாம்பொதுநின்றுன்றாச்சீ
ரறமொன்றேகுறையொன்றின்றிப்
புலத்தெல்லாமாகுமெனிற்புறவிகிர்த
மொன்றென்றார்புலமைமிக்கார்.
காறுபடுத்திறத்திவன்கைப்பொருள்வற்கே
யிவற்கவன்கைக்கருமம்வேண்டி
வேறுபடுமனுக்குலமேயொருப்படுத்து
மிருகையாமிடிவாழ்வன்றிக்
கூறுபடுத்திறத்தென்றும்வாழ்ந்தறவோ

ரழத்தீயோர்க்குவிற்காண்டி
வீறுபடுநாளில்வருமிருவினைவி
யாப்பயன்பின்பில்லையென்பார்.
திறந்தசாவாழ்விதுவாய்த்திறம்பாவான்
வாழ்வதெனத்தெளியநாமே
பிறந்தகாலுயர்குலமுஞ்சீர்த்திறமுந்
தெரிந்திங்கள்பிறப்பாரின்றி
பிறந்தகாலுயர்வான்மேவிணையாவாழ்
வுற்றாருமியல்பொன்றன்றே
மறந்தகாநல்வினைநாஞ்செய்யளவொத்
தன்றெவர்க்கும்வழங்குமென்றான்.
எற்றருமுணர்வினையியைந்தநானலோர்
போற்றாரூழ்வினையெனப்புகன்றபின்
மாற்றருந்தலைவிதிமறுப்பயோவென்றான்
றேற்றருமயிற்பறவனனுஞ்செப்பினான்.
ஊழ்வினையென்னினுமுரிமையோர்ந்துழி
மாழ்வினையியற்றநீவகுத்தவக்காத்
தாழ்வினையென்பயோவிறைவன்சாற்றிய
கீழ்வினையிலமறைவிருப்பிக்கேட்டியால்.
நீட்டியவிதியலாற்செயப்படாச்செயுங்
கோட்டியவினைவிதிகோட்டமாமலால்
வாட்டியமனஞ்செயும்வடுவதோவிவ்வா
றீட்டியவறமறமிரண்டிலாமரோ.
இவ்விதியிலையெனவியம்புமூழ்வினை
மெய்விதிமறையினால்விளங்கமாக்களைச்
செவ்விதியிறைவன்முன்றிருட்டித்தாயகா
லுய்விதியிழந்தவர்க்குற்றதோதுவாம்.

வாயேயுணாநஞ்சுறப்பெல்லாமருவிவருத்தும்வண்ணமெனத்
தாயேதாதைகொண்டவினைதனையராநாங்கொண்டழுங்கத்
தீயேவியதிதொடுசனித்துத்தெளியாவுணர்வின்மனங்கலங்க
நோயேபாலுண்டிடர்கரத்தினுடங்கவினையின்விளைவுற்றோம்.
சொன்னசூரர்காலமெனத்துதிநூலோர்முற்பிறப்பென்றார்
முன்னமமராலெமக்குற்றமுதியவினையூழ்வினையென்று
ரின்னவினையல்லாதுதலையெழுத்தும்வேறூழ்வினையுமிலை
யன்னபிறப்பல்லாதிறந்தேயுயிர்த்துபிறப்பாரிலையென்றான்.

" *Although what thou hast spoken is right,*" *yet, said Sivasiven,* " *do thou, who art learned in this species of knowledge, declare, whether, if the effects of the deeds of previous births be denied, the inequality of men in this world, some being deformed and some beautiful, some happy and some miserable, be just or unjust ;*" *then Joseph the bearer of the flowering rod, whose pleasant speech flowed from a mouth graced by kindness, again explained the scriptures of the true faith.*

" *He, who hath neither beginning, nor end, nor similitude, is the everlasting, sole, all-righteous God ; the celestial beings and our souls, between which there is no difference, having been created, have a beginning, but no end ; irrational beings have both a beginning and an end ; this being the true faith, in what state were our souls when first created, before they had been guilty of any crime ?*

" *When our souls first entered our bodies and appeared in the world, did they resemble prosperous princes free from all misery ? but though they did not and though their condition therefore, was various, was this inconsistent with the justice of the Almighty God? if it were just then, also, must the inequality of men in their present generation be immutably just, without reference to the effects of their former deeds.*"

The former, Sivasiven, said—" *that it was destiny which was the cause of inequality at the first generation of mankind ;*" " *but, said Joseph,*" *is it consistent with the mercy of the Almighty, the God of justice and mercy, to predestine such inequality ?*" " *It is the divine will of him who is beyond expression,*" *rejoined the other.* " *Then, replied Joseph,*" *can it be wrong to say that it is the divine will which causes the various qualities of those born in after generations?*

" *As the clouds pour down rain even in the thorny wilderness, so the all-wise God scattereth abundantly the vain wealth of this world even among the unworthy ; but he hath given power to all, to each according to the intensity of his desire, to attain to the matchless glory of the wealth of grace: can it be then said, O thou of superior understanding! that the other kinds of wealth, which are in truth illusory, are the reward of virtue ?*

" *Do all streams meet at one place ? do all trees bear one sort of fruit ? Is there one kind of production from all soils ? have all one countenance ? As all these are different, so differ the conditions of men, but virtue only, a species of wealth liable to no diminution, is common to men of all ranks ; those eminent for wisdom, therefore, describe it as common to all and make no other distinction respecting it.*

"*As the wealth of the rich is necessary to the poor and as the industry of these is necessary to those, so wealth and poverty resemble the two hands, uniting the several classes of mankind; if the virtuous were always seen rejoicing in prosperity and sinners weeping in adversity, they would then deny the retribution for good and evil at the last day.*

"*That we might understand that the prosperity of this world is not constant and that the felicity of heaven is eternal, we know not, said Joseph, at our birth whether we are born to high rank and fortune, but, if desirous of attaining the unequalled joys of heaven, we know at our death that they will be in proportion to the works we have performed during life.*"

"*O learned man worthy of all praise,*" *said Sivasiven,* "*as the wise assure us that unavoidable effects proceed from the deeds of former births, can it be said that there is not an inevitable destiny?*" *Then Joseph, desirous to satisfy all his doubts, however difficult to clear up, answered thus;*

"*When the nature of that which the wise have called the effect of former acts is rightly perpended, can it, as thou hast affirmed, be considered as proceeding from a prescribed destiny? Listen sedulously to the explication of the exalted faith taught by the Lord.*

"*If there be a prescribed destiny it is impossible to avoid it; all crooked actions, therefore, must be considered as the fault of destiny, not the fault of the mind which it affects; all virtuous actions, also, must be referred to destiny and cannot be considered as virtues of the mind; consequently, neither virtue, nor vice can be attributed to men.*

"*To demonstrate that which is called the effect of former acts not to be destiny as thou thinkest it, I will declare, as it is stated in the scriptures of the true religion, what occurred, when the impartial God created mankind, to those who had forfeited their lives.*"

Note.—Here follows an account of the fall of Adam and Eve, which concludes with the two following verses.

"*As poison swallowed by the mouth spreadeth agony through all the limbs, so we, their children, are born to the evils arising from sin, by which we are afflicted in consequence of the acts of our common parents, and to the pains caused by mental confusion proceeding from an overclouded understanding; vexed by the hand of sorrow, we receive the whole fruit of their acts.*

"*The period of the creation of our common parents, here mentioned, the illustrious sages have called the former birth, and the acts done by them in ancient time, the evil effects of which we experience, they have called the effects of former acts; besides that which is here stated, there is no prescribed destiny, nor effects from former acts, nor, after men have been born and have died, are they liable to any future birth.*"

Specimen of Father BESCHI'S *Poem, translated by the Rev.* Mr. E. HOOLE, *and published in his Narrative.*

THE DESCRIPTION OF THE CITY OF JERUSALEM.

பயனினான்மறைநூலொக்கும்பகலினைமணியாலொக்கும்
வியனினாலுலகமொக்கும்வேலியாற்கன்னியொக்கும்
முயலினாலலையையொக்குமுனிமுனிவொன்னார்க்கொக்கும்
நயனினாலுயர்வீடொக்குநகரினையொக்கும்வீடே.
பொற்றங்குமுலகத்தன்னைப்பொங்கிருங்கடல்சூழ்ந்தென்ன
விற்றங்குமிரவிகாலும்வெயிற்பிழம்பனையநாறிச்
செற்றங்குமலையினோங்கிச்சேணுறுமதிலைச்சூழ்ந்த
வெற்றங்குமலையைமாறியிகன்றகலகழித்தோற்றம்.
பூவுலகியல்பன்றம்பொற்பொலிமணிநகரம்பொன்னார்
தேவுலகுரிதென்றங்கட்டெளிந்துபுக்கிடுமென்றாழி
தாவுலகிருந்தவெள்ளித்தாடளையிட்டதேபோற்
கோவுலவிஞ்சிசூழ்ந்தகுவளைநீளகழித்தோற்றம்.
சீரியார்நட்புவேர்கொள்சீரெனநிலத்திற்சூழ்ந்து
பூரியார்நட்புப்போலப்புணர்ந்தசைவலமேலாடி
நாரியாரஃகுகாணநாணியகமலமிங்கண்
வேரியாரிதழைப்பூத்துவெறியெறியகழித்தோற்றம்.
ஈரும்வாளெயிற்றின்கூன்வெண்ணிளம்பிறைதோன்றலூனைச்
சோரும்வாய்விரித்துக்கட்டீப்ச்சொரிதரவகழிதாழ்ந்து
பேரும்வாயுருக்கொண்டன்றுபேய்க்குலம்வெருவுய்த்தெய்தி
பூரும்வாயென்னவங்கண்ணுழக்கியவிடங்கரீட்டம்.
ஓவலிற்றெழிற்பூமாதேயுவந்தநாட்செறிந்தகற்றை
தூவலிற்பகல்செய்பைம்பொற்சுடர்முடிசூழ்ந்ததென்ன
வாவலிற்கிளர்நன்றாட்கொண்டடிகடம்மனத்தைக்காக்குங்
காவலிற்கதுவிடாதகனககமாமதிவின்றோற்றம்.
காரணிபசும்பொற்குன்றின்காட்சிபொன்மதிலைச்சூழ்ந்து
சீரணியனைத்துஞ்சேர்ந்தசெழுநகர்திறந்தவாயில்
பேரணியவையுமீட்டிப்பின்னவையுவப்பிற்காட்டப்
பாரணிப்பேழையாரும்பயன்படத்திறந்தபோன்றே.

" *This city, from its universal advantages, may be compared to religion; from the brightness of its ornaments, may be compared to day; from its extent, it may be compared to the world; from the keeping of its walls, it may be compared to a pure virgin; from its crowded state,* *it may be compared to the sea; to its enemies, it may be compared to the anger of saints: for goodness, it may be compared to heaven, and heaven may be compared to this city.*

" *Like as the great sea surrounds the golden world (earth) so was the beauty of the wide moat varying its bright waves, and surrounding the walls (of Jerusalem), which shone like a multitude of the solar rays, rose like a mountain to the water of the clouds and pierced the sky.*

" *This extensive moat at the foot of the heaven-reaching walls, seemed like a silver shackle to detain the beauteous city on the sea-girt earth, for fear it should esteem the earth an unsuitable situation, and ascend to heaven as a more appropriate place.*

" *This moat was deep as the deeply-rooted affection of the great; the green weeds in it played on its surface, unstable as the affection of the mean; and the lotus outshone by the beauty of the damsels, could not stay within the city, but here opened its tender leaves and breathed its fragrance.*

" *There were swarms of contending crocodiles, shewing teeth sharp as a sword, and curved like the fair new moon, opening their fleshy mouths, and flashing fire from their eyes, as though the moat had formerly been deepened to hell, and the demons lying there had assumed and wandered about in a terrifying form.*

" *The beauty of the golden walls, was as though the ever-fair earth on a day of rejoicing, had put on a crown of pure and radiant gold; they were no more to be surprised than the temper of holy men, who are filled with goodness beyond desire, and who keep their minds.*

" *As the golden mountain is surrounded by clouds, the city surrounded by a wall enclosing all wealth within it, had a gate which when opened was as though the earth had opened a casket, in which all its treasures had been collected with a desire to display them for universal advantage.*

" The remaining part of the description is equally imaginative; designed to please the fancy of a Hindoo rather than to convey a knowledge of facts.

" The following extract will exhibit the method in which *doctrine* is inculcated in the Tembavani—the two first verses are represented as the words of the Saviour, addressed to Joseph; the third contains Joseph's reply.

உள்ளியதவநல்வெறியுக்சநீண்மரத்தைநாட்டி
விள்ளிடவன்புமுட்கும்வியனிருபாயும்பாய்த்தித்
தெள்ளிபவரக்சால்வீசத்தியானமீகாமனுகை
வள்ளியவினைநீரீர்த்தூர்ந்தரிதில்வீட்டுலகிற்சேர்வார்.

வவ்வியதவங்கெட்டம்மாமரக்கலங்கவிழ்ந்ததேபோ
லவ்வியமுன்னீர்மூழ்கியழுந்துவர்பலரிவர்க்குட்
கவ்வியவுணர்வின்றெப்பங்கண்ணினீர்க்கடலைநீந்திச்
செவ்வியகதியின்வீட்டைச்சேர்வோரிருவொன்றுன்.

மெய்க்குடத்தமிர்துண்டன்னவிரித்தசொற்செவியின்மாந்திப்
பைக்குடத்தனையதியார்பான்மையென்றுனுஞசுட்ட
வக்குடத்தழிவுதிர்த்தலரிதெனத்தவநீத்தாரு
மிக்குடத்தனையதெற்றொன்றனன்மதுப்பெய்கோலான்.

"*Embarking on the ship of true renunciation of the world, and setting up therein the tall mast of strong determination, spreading the two broad sails of devotion and godly fear, whilst the breeze of the excellent gifts of God blows upon them, the pilot of unceasing meditation steering them through the sea of this sinful world, they shall reach the desired haven of eternal bliss.*

"*But whilst the ship of renunciation thus sails along, some, by corruption of the penance they had commenced, will sink into the sea of sin, and perish as though by the upsetting of the vessel: some among them (one or two only) seizing with earnestness the raft of repentance and floating in a sea of tears, directing their course straight forward, shall obtain the joys of heaven. Thus, although it is difficult rightly to perform penance, it is far more difficult for those who leave off that which they had commenced to reach the shores of heaven.*

"*Joseph, the possessor of the branch which blossomed with honey-dropping flowers, attended to all the divine Son uttered; and by the mouth of his ear drinking in the nectar poured from the vessel of truth, thus replied: We may consider the wicked like to an unbaked earthen vessel, which when broken it is easy to join again, and to bake in the furnace of penance; but as it is impossible to join again a vessel broken after it is once baked, so it is most difficult for those who have left off to be penitent to be restored.*"

Appendix No. 2 –*Illustrations made by Father* BESCHI *on a couplet of the Cural.*

See Ellis's Cural, page 88.

மனத்துக்கண் மாசிலனாதலனைத்தறன்
ஆகுலநீரபிற.

That which in spotless purity preserves
The mind, is real virtue; all besides
Is evanescent sound.

"That which in spotless purity," &c.—Vira-mamuni in the third book of the Tonnūl, பொருளதிகாரம் (Poruladigaram) *on the subject matter of composition,* has particularly examined and illustrated this couplet. He introduces it twice; in the first chapter, in which the rules for the composition of prefaces are stated, and in the third chapter, on amplification, where it is made the thesis of a theme or dissertation, intended to exemplify that species of composition. In the former it is thus paraphrased.

இல்லறந்துறவறமெனவிவ்விரண்டினுள்ளு மடங்கிநிற்குமெல்லாவறங்களுமனத்தின்றூய்மையாற்பேறும்பெருமையுமடையுமெனவும் மனத்தினுண் மாசுகொண்டவன் செய்யுந்தவமுந் தானமுமறறயாவுமறத்தினரவமாவதன்றியறத்தின்பயனுளவல்லவெனவு. மக்குறளிருபயனிவையெனவிரித்துக்காட்டுதும்விரிப்பவே.மெய்யும்பொய்யும்விளங்கியுட்பயன்றருமெய்யறத்தின்றன்மையேவெளியாகித்தோன்றுணர்த்துநாமதற்கொப்பநடத்தாலிதுவீடெய்துவழியெனக்காணப்படுமே. பெரும்பொருணேர்த்துபொய்மணிகொள்வதுகேடென்றுயினும் பொருளைநேர்ந்து முடலைவாட்டியுமுயிரைவருத்தியுமேற்கதிவீட்டித்செல்லாச்சிலபொய்யறங்களையிட்டுவத்திலுங் கேடாமன்றோ. இதனை விலகித் தன்னுயிராக்கங் காப்பது வேண்டி யிக்குறட்பயனாய்வது நன்றே.

Every species of virtue is included under the two general heads of domestic virtue and religious virtue. It is here said, that by purity of mind, eminence and worth is obtained and, that devotion, or charity, and all other acts performed by one whose mind is not pure, hath only the empty sound and not the essence of virtue. The two significations of this Cural are thus distinctly shewn. When thus explained the truth and falsehood shine forth, and the true nature of virtue, whence substantia profit is derived, becomes apparent, and if we reflect on this and act accordingly, the path leading to salvation will be seen. Although loss be *sustained by the expenditure of vast wealth in the purchase of a false jewel, is it not yet a greater loss, after the wealth has been expended, the body emaciated, and the soul afflicted, that a few, false virtues only, not current in heaven, should be collected? avoiding this, therefore, and endeavouring to preserve that which is really profitable to the soul, reflect seriously on the purport of this Cural.*

The following extracts from the dissertation of which this couplet is the thesis contains the citations from Tamil writings made by this author in direct illustration of it.

புறத்தறச்சாயற்புகழ்ப்பிறர்மெய்த்-திறத்துளத்தம்மைத்தீயெனச்சுடச்சுடச்-செறிவார்மருளறத்தெளிந்துமெய்ம்மைகண்-டறிவாரறப்பயனாசையுட்பட்டார். இதனாலன்றே

வானுயர்தோற்றமெவன்செய்யுந்தன்னெஞ்சந்
தானறிகுற்றப்படின். என்றார் அன்றியும்

நீட்டியசடையுமாகிநீர்மூழ்கிநிலத்திற்சேர்ந்து
வாட்டியவுடம்பின்யாங்கள்வரகதிவிளைக்குமென்னிற்
காட்டிடைக்கரடிபோகிக்கயமூழ்கிக்காட்டுணின்றும்
வீட்டினைவிளைக்கவேண்டும்வெளிற்றுரைவிடுமினென்றான்.

துண்டுகில்வேகலஞ்சிநெருப்பகம்பொதிந்துநோக்கிக்
கொண்டுபோய்மறையவைத்தாற்கொந்தழல்சுடாதுமாமோ
கண்டத்திருவியார்தங்கடிமனைதுறந்துகாட்டுட்
பண்டவாவுளநீங்காதேற்பாவமோபரியுமென்றான்.

இங்ஙனேபுறத்தவவேடமன்றியுள்ளத் தூய்மையில்லா முனிவர்க்குச்சிந்தாமணியிற்சீவகன்சொன்னான்.

வானோர்புகழ்ந்துவணங்கியதுறவுந்
தானோர்பயனிலதராதகத்தழுக்
காறுளதேலெனிலகத்துளறத்தின்
பேறுளதென்பதுபிழையோவென்பார்.

என்பதிவையுமித்தொடக்கத்தன்பலவுங் கரிப்புறத்திணையாம்-இவ்வாறேனைத்திணைவேண்டுளிவிரித்துக்கூறுக.

Those desirous of obtaining the fruit of virtue, having freed themselves from the delusion, arising from the applause given by others for the appearance of virtue, while in reality their conscience burned within them like a fire, will comprehend the truth. For this reason hath not the Author said thus?

CURAL.

Of what account is the understanding, which reaches beyond the heavens, if his heart suffer from conscious guilt.

And again;

CHINTAMANI.

If it be thought eternal felicity can be obtained by wearing long and matted hair, by bathing in water, lying on the ground, and emaciating the body, then may the bears that bathe in the lakes and wander in the forests, also, obtain felicity;—quit, said he, such ignorant notions.

If from fear of a fine cloth being burned you place it within the very fire, will it not be consumed? So, if they, who forsake domestic life and the society of those whose bosoms are perfumed by civet, retain in the wilderness their ancient desires, will they, said he, be freed from sin?

Thus, in the Chintamani, Sivagen addresses one, who, void of inward purity, has assumed the garb of outward devotion.

If the mind be inwardly impure, even devotion, which is reverenced and praised by the heavenly beings, will produce no permanent fruit, but can they impute guilt to him (even if such ceremonies be omitted) who is endowed with inward virtue?

These passages and many others like these prove what has been stated by direct examples, if further illustrations be required they may be given at large.

Note—Mr. Ellis has translated only a few out of many reasons and rules connected with logic and corresponding with the above subject. The following is the last part of the same.

These extracts are intended to exemplify the position, that, whatever eminence may be acquired, neither virtue nor the permanent benefit of virtue can be possessed by those innately wicked; they are from the 2d canto (இராவணன் மந்திரப்படலம்) of the sixth book (யுத்தகாண்டம்) in which Cumbacarnen, one of the brothers of Rávanén, reproves, in a council of the Giant chiefs, the conduct of the former, in forcibly seizing and detaining Sitei, the wife of Rámen, and vainly endeavours to persuade him to restore her to her husband. Previously to the holding of this council, Anumán, one of the leaders of the silvan tribes that accompanied Rámen to the attack of Ilangei, who, though in the form of an ape, was in reality an incarnation of Pavanen, the god of the wind, had penetrated to the capital of Rávanén in search of Sitei and, having been taken prisoner, had been allowed to depart after his tail, wrapped in oiled cloth, had been set on fire as the punishment of his intrusion; with the torch so furnished him, he had laid the whole city in ashes, finally escaping unhurt in defiance of the utmost efforts of the Giants:—hence the allusions in some of the following verses.

Rámāyanam.

ஓவியமமைந்தநகர்தீயுணவுளைத்தாய்
கோவியல்பழிந்ததெனவேறொருகுலத்தோன்
றேவியைநயந்துசிறைவைத்தசெயனன்றே
பாவியருறும்பழியிதிற்பழியுமுண்டோ.

Thou hast caused a beautiful city to be devoured by the flames; is it right to desire the wife of one of another race and to detain her in captivity as if thou hadst lost every kingly quality? is any sin the wicked commit a greater sin than this?

என்றொருவனில்லுறைதவத்தியையிரங்க
வன்றொழிவினாயமறைதுறந்துசிறைவைத்தா
யன்றொழிவதாயினவரக்கர்புகழ்யா
புன்றொழிவினாமிசைபொருந்தல்புலமைத்தோ.

Contrary to the precepts of religion, thou hast detained in captivity and overwhelmed with sorrow, a woman who was engaged in devotion, belonging to the house of another, O perpetrator of violent acts! and if in that day the glory of the Araccar was obscured, would it be wise in us to sanction so disgraceful an act?

தூயவர்முறைமையேதொடங்குந்தொன்மையோ
ராயவர்நிற்கமற்றவுணராதியாந்
தீயவரறத்தினாற்றேவராயது
மாயமோவஞ்சமோவன்மையேகோலோ.
அறந்துறந்தமரலாவென்றவாண்டொழிற்
றிறந்தெரிந்திடிலதுதானுஞ்செய்தவ
திறத்திறம்பாவகையியற்றுநீர்மையன்
மறந்துறந்தவர்தரும்வரத்தின்மாட்சியால்.
மூவரைவென்றுமூவுலகுமுற்றுறக்
காவலினின்றுதங்களிப்புக்கைமிக
வீவதுமுடிவெனவீந்ததல்லது
தேவரைவென்றவர்யாவர்சீரியோர்.
வினைகளைவென்றுமேல்வீடுகண்டவ
ரெனையரென்றியம்புதுமிவர்த்தந்தீய்மையான்
முனைவருமமரருமுன்னும்பின்னரு
மனையவர்திறத்தினையாவராற்றினார்.

The ancients followed the path of the virtuous, but besides these all the other Auner (Giants) are evil doers: the station of gods is obtained by virtue, but is it obtained by delusion, deceit and violence?

If we consider the mighty deeds by which, even after we had forsaken virtue, we conquered the gods, we shall find that they were not an effect proceeding from any acts of devotion performed by ourselves, but from the power conferred on us by those who had forsaken evil (i. e. by the Sages and the gods by whom we were endowed with power).

Having conquered the divine Triad, and having received under their protection the whole world, while exulting in prosperity, they are dead and have toiled in vain; who then among the conquerors of the gods are truly great?

Who shall describe those, who, having overcome both good and bad works, have obtained eternal felicity? but who among these, the giants, have, from their innate wickedness, at any time performed virtuous acts like the sages and the gods?

கோனகர்முழுவதுநினதுகொற்றமுஞ்
சானகியெனும்பெயருலகின்தம்மனை
யானவள்கற்பினுலழிந்தவல்லது
வானரஞ்சுட்டதென்றுணர்தல்மாட்சியோ.

This royal city and thy former victories have been consumed by the chastity of Janiki, the mistress of the world; if not, what glory is there in the thought that they were burned by an ape?

மீனுடைநெடுங்கடலிலங்கைவேந்தன்முன்
ரூனுடைநெடுந்தவத்தளர்ந்துசாய்வதோர்
மானிடமடந்தையாலென்றவாய்மொழி
தேனுடையலங்கலாயின்றுநேர்ந்தியால்.

It was foretold that the power of the king of Ilangei surrounded by the ocean, obtained by long penance, should decline by means of a female of the human race; know this to be now accomplished, O thou who art adorned with a wreath of sweet flowers!

மனவிருளிரிய மணிவிளக்காகத் தனியருளிறைவன் றந்தமறைநூலாய்ந்துழியீண்டியா னுரைத்தயாவும் வாய்த்தமெய்யென வழங்கித் தோன்றுமே.

நுந்தாயெனபுகழ் நுவன்றபாட வேற்றாசெரிட்பலிமென்மேற்கொன்றிட அப்புகழப்பலி யனையநும்மனம். ஒப்பிலாதென்னை யொருவிதிற்றலால். அவையெலாம்பொய்ப்பொருளாகக்கொள்ள

நவையெனவெறுத்தனேனானேயெனவும். புணர்ந்திடத்தேவ பூசையி னேர்ச்சி கொணர்ந்துழிபகையுட் கொண்டதென்றுணர்பின். அகன் றப்பகைதீர்த் தல்லாற்பூசையு நகன்றுமறப்ப. னானேயெனவும்.

மாசிலான்மறையென வுறைத்தபின்மனத்துண் மாசிலனாதலே மாண்புறுமனைத்தற னல்லதுநீயவைவயகத் தொளித்தினிய. வல்லுருப காட்டன் மாணறமென்பவோ என்பதிவையுமித்தொடக்கத்தனப லவுநூற்புறத்திணையாம்.

All that I have stated will be verified, if you look at the true religion which was inculcated by the one only gracious God, who said, as precious light to expel the darkness of the mind, thus;

[Amos 5, 21.] I hate, I despise your feast-days, and I will not smell in your solemn assemblies. Though he offer me burnt offerings and your meat offerings, I will not accept *them*: neither will I regard the peace offerings of your fat beasts.

[Samuel i, 15—22.] And Samuel said, Hath the Lord as great delight in burnt offerings and sacrifices, as in obeying the voice of the Lord? Behold, to obey is better than sacrifice, and to hearken than the fat of rams.

[" Matt. ch. v. 23—24.] Therefore if thou bring thy gift to the " altar, and there rememberest that thy brother hath ought against " thee; leave there thy gift before the altar, and go thy way; first be " reconciled to thy brother, and then come and offer thy gift."

Explanation of the word ஆகுலம், introduced in the foregoing couplet or text.

" All besides is evanescent sound"—The term in the original, translated by the two concluding words, is ஆகுலம், which signifies literally *a loud turbulent noise ;* the line is thus translated and explained by the Latin commentator. " *Cætera omnia conditionem habent strepitus.* Sensus est eam esse veram virtutem, quæ in animo culpam non admittit, nam animum culpa fœdatum habentis, verba, et habitus, et actiones ipsæ quæ virtutem spirent, habent conditionem strepitus; tum, quia ad id ordinari solent, ut a cæteris videantur et audiantur; tum, quia eo tantum tempore quo videntur et audiuntur, ut virtuosa laudantur, sed statim, uti strepitus, evanescunt, quia non valent alicui beatitatem afferre." I have followed this interpretation as it agrees with that of

Vira-mamuni, and as it corresponds exactly to the expression of the original; but the word ஆகுலம் may metaphorically be rendered, *ostentation, hypocrisy.* Parimel-azhager paraphrases it by ஆரவாரம் which signifies literally the *confused clamour arising from a mob,* but is often synonymous with இடம்பம், the term commonly used to express *pomposity, ostentation, hypocrisy.*

VI.—*Notice regarding the Sects of Hindus called Tengala and Vadagala.*

—*By* C. P. Brown, *Esq.*

The following brief notice regarding these sects is now collected from living authorities, who themselves are Bramins of the Tengala sect.

The Vaishnava sect in the peninsula of India is divided into two classes, called Tengalas and Vadagalas, who hold each other in religious hatred. These divisions affect Sudras as well as Bramins.

They are known from one another by the mode in which they wear the mark in the forehead. Each sect wears an upright yellow or red streak, down the forehead. And on each side is a white line; these converge at the brows, forming an appearance like a trident.

The Tengalas draw the line low down the face. The Vadahalas draw it no lower than the brow.

The Tengala marks join on the nose. The Vadagala mark does not. The Tengala wears a line across the face between the eyes, somewhat like a crescent.

The Tengala women wear the yellow upright line: a few women wear the lower mark. No woman wears the white marks.

The particular saint of the Tengalas, whether Bramins or Sudras, is *Manavala mā muni;* who wrote the comment on the *Dravida Prabandham (*or *Tamil Veda),* written by the twelve saints called Alwars. This sage has been deified by his followers, while Vedantachari is adored by the Vedagalas. He and his *opponent* (a phrase which they disown) were pupils of *Ramanujachari,* commonly called *Bhashya-carlu,* or the " Commentator" on the Divine Texts. It is to be observed that neither sect speaks disrespectfully of the leader or apostle of the opposed sect. And it is not easy to comprehend how both teachers can be supposed to obey the doctrines of Bhashyacarlu.

The prayers they use are similar, except as to the commencing stanza. The Tengala mantram or verse runs thus:

Sri Sailésa dayā pātram, dhī bhacty ādi gun'ārn'avam
Yatīndra pravan'am vandé Rámyajā mātaram munim.

But the Vadahalei exordium runs thus:

Rāmānuja dayā pātram, jnāna vairāgya bhūshan'am
Srī madvēncata nādhāryam vandē vēdānta Dēs icam.

In the former verse Rāmyaja Matrī is the name of Manavala mamuni: in the latter, Védanta Desica is the title given to Védantachari.

It seems that the former verse is used in all the temple at Combacōn'am, and that at Manjācuppam, north of Pondicherry; perhaps at a few others.

This verse is used in *private* by the Vadagalas, but if they ever venture to recite it audibly in a Tengala pagoda it is resented as blasphemy, and leads to great outrages.

Ten-calei, denotes *Southern Veda;* and *Vada-calei* denotes the *Northern creed.* These words form the origin of Tengala and Vadagala.

Among the Vadagalas widows are shaved. This custom the Tengalas reject. There are some other discrepancies. They intermarry and eat together.

But the discriminative mark in the forehead is the great sign, and so important do they hold this that various Vishnu temples have the sectarial mark cut in stone over the gate.

The discussion regarding this mark is traced to a difference of opinion as to the signification of a celebrated Sanscrit text or half verse, which directs that the mark in the forehead shall be *Nāsādi kēsa Paryantam*, "from the nose to the hair." Now the Vadagalas say this expression *from* the nose denotes not any *part of* the nose, and therefore they begin the line between the brows.

The Tengalas deny this; and dividing the nose into three parts, declare that the *upper third* of the nose is included in the word ādi. For they argue that "every thing has a beginning, a middle, and an end; and in the verse in question the word "adi," *beginning*, denotes the first portion."

This discussion (a counterpart to that of the big-endians in Swift's description of Lilliput), has led to serious disturbances and the loss of many lives. Nor does any annual feast occur without a recurrence to the wrangling regarding the celebrated verse now cited. It is not even satisfactorily ascertained in what book this verse is recorded. A learned Tamil divine, who died about fifteen years ago named Annavappengar, author of a commentary on the Uttara Rama Charitra, wrote likewise a polemical volume on this topic.

It is to be observed that both sects worship the same god Vishnu; and use the same rites. Their differences regard none but points which are known to be mere trifles. Indeed, they chiefly regard particular customs connected with eating and drinking.

The Ecādasi Srāddham is not practised by the Tengalas, nor do they use the bell in worship.

The Tengala sect has prevailed greatly over the other, who are nearly silenced both at Sri Rangam, (Trichinopoly) and Madras.

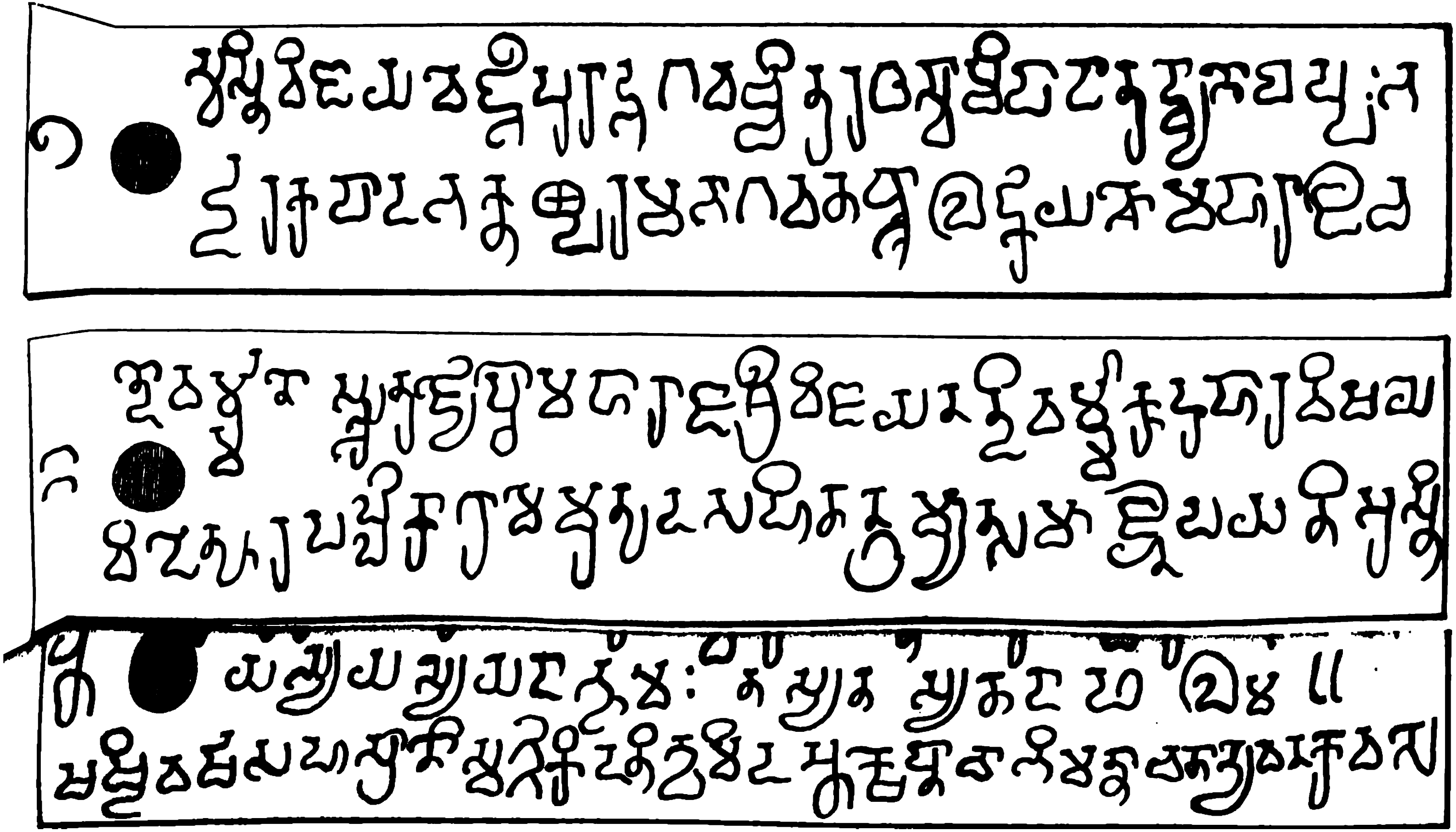
At the sacrifice called Yajna, the Tengalas say they use the *pishta pasuh*, or small figure of a goat, made of paste. The others use the *chhaga pasuh*, or living goat. But in fact both sects have laid aside the yajna: which the Smartas continually celebrate. Hence among the Tengalas and Vadagalas, the name Somayazi is laid aside: for that title appertains to the Bramin who has celebrated this sacrifice.

VI.—*Note on an Ancient Hindu Grant.—By* Walter Elliot, Esq.

Some time ago I obtained a set of copper-plates, united by a ring in the usual mode of ancient Hindu grants, bearing an inscription in a character which was said to be unknown. The plates are three in number, $7\frac{8}{10}$ inches long by $1\frac{1}{2}$ in breadth, of a shape differing from any I had hitherto met with. Unfortunately the symbol on the ring or seal is defaced. The plates were said to have been found in the *kol*, or lake, near Masulipatam, some years ago, and had been laid aside as utterly unintelligible.

Several of the letters being nearly identical with the Hala Canarese alphabet, most of the words were with some difficulty deciphered. The characters bear a considerable affinity to those of an inscription from Amrawutty, published in the Journal Asiatic Society* of Bengal, but appear to be of a considerably older date, if such an inference may be drawn from the ruder and more simple forms of the letters, as will appear from the fac-simile opposite, which shows likewise the shape and size of the copper-plates. The language is Sanscrit, the style being simple

* Vol. vi. p. 218—Pls. xi. xiii.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though old, and some of the terms obsolete. A transcript in Nagari is given, the translation of which is as follows:

" Salutation!

" From the victorious Vengipur, Maha-raja-sri-vijaya-Nandi Varma, " bound up in meditation on the feet of the Lord Chitra Ratha Swami— " devoted to the feet of the saints (Bhaturakas)—the most pious—the " eldest son of Maha Rajivacha Varma and of Kulanka—commands the " villagers, and the head inhabitants of the village of Vidanūrpalli, in the " district (Vishaya) of Kūdūhāra—Hail!—On account of the virtue of " my imperishable Kula and Gotra, and for the increase of my personal " reputation, the village is bestowed (vrittaha) on the Bramins re" siding in the excellent agraharam of Chinnapākūrvaka, of various " gotrams, readers of the vedas, who are in number 157—knowing this, " let all that is proper to be relinquished, be given up, by the Rajah's " public officers, who have authority over the land (desadipati), and let " it be maintained.

" On the eighth day of the decreasing moon, in the month of Poushya, " in the 7th year of the prosperous reign, this grant [pattika] is made. " Let the grantees enjoy it in virtue of this order.

" Land has been given by many, and it has likewise been continued by " many. Whosoever possesses the land shall enjoy the fruits for the " time being.

" The giver of land rejoices in heaven for 60,000 years. He who takes " it away, or consents to its resumption, shall remain for the same period " in hell."

This ancient deed though unfortunately destitute of an ascertained date, is possessed of considerable interest, from the indication it affords of the dynasty which ruled in the tract now known as the Northern Circars, but anciently as the Venga, Kalinga, or Andhra Desams, anterior to the Chalukya family.

The earliest grants of the latter race occur in saca 528, corresponding to A. D. 606, and I have lately had opportunities of examining copper sasanams, given by different princes of this house, in sacas 897 and 1001, which clearly show by the more modern form of the writing, the superior antiquity of that of Nundivarma.

In these documents the genealogy of the Chalukyas is brought down to the union of the family with that of the Cholas of the south, about the close of the 10th century of the Salivahana æra, without the mention of any names, bearing the least resemblance to Rajivaksha Varma or Nundivarma, and as the country over which they reigned is invariably termed Vengidesam, we may conclude that the Nandivarma who reigned at Vengipur must have been anterior to the 7th century.

No such names as Nandivarma's or his father's occur in any of the lists of the Southern Dynasties, except in that of the Vijavanagur Rajas,* but the Nanda who is there said to have founded Warungol and Nundapur in A. D. 1034, (?) cannot possibly be identified with the Nanda of the inscription, for at this period the Chalukyas were the lords of Vengidesam.

Of the limits of Vengidesam or Vengi Mandalum, it does not appear necessary to say more at present than may tend to illustrate the site of Vengipur, the capital of Nundivarma.

Four places of this name are found in the Northern Circars. Two of these named Chinna Vengi and Pedda Vengi are situated close to each other, in the vicinity of Ellore; another is found near Chintapalli in the Guntoor district, and the 4th is a deserted site, named Vengipad, in the Palaveram zemindary, to the north-west of Rajahmundry.

The following account of the two first mentioned places was received from an intelligent native, who made the inquiries on the spot.

" About eight or ten miles north of Ellore, is situated the village of Peda Vegi, half an hours walk to the north of which is Chinna Vegi, and five miles south of these, is another village named Dendûlûr, with several hamlets attached to it, named Ganganagudem, Sanagudem, &c. According to the local tradition all these formerly constituted one large city, in which were numerous temples dedicated to Siva. The ruins of about fifty fanes sacred to this deity, still exist in Dendûlûr, and likewise four statues or idols of Vigneswara, one of which, very large, is on the southern side of the village, near a tank surrounded by date trees. A high mound of earth called Bhimalingam Dibba is found on the east side of the village, and a tank, named Macalama cheravu, to the north, has a mound in the centre, on which are two stone bulls. There is another tank to the west of the village, called Narikalawari cheravu, on the banks of which are two sila sasanams, standing upright, and two more which have fallen down, but which were erect about four years ago.

" Between Pedda Vegi and China Vegi is another remarkable mound. All of these places above mentioned are supposed to conceal enormous treasures. In later times Pusapati Madava Varma reigned in this place."

The above are sufficient indications of the site of a large city, and the inscriptions noted as still existing at Dendûlûr, will probably throw further light on the subject. Wangipur in the Guntoor district seems to be a place of no importance, but at Vengipad, north-west of Rajahmundry, there are said to be extensive ruins, but the head serishtadar of that district, in reply to some questions addressed to him, states, that the local tradition of that province, points to Pedda Vegi in the Masulipatam district, as the former site of Vengipur.

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* As. Res. vol. xx.

In the preface to the Telugu translation of the Mahabharat, Rajahmundry is styled the "central gem of Vengidesam," "Nayakaratnam." Campbell's Tel. Gram. pref. p. x. At that time it had become the capital of the Chalukyas, and the ancient capital must have been in a state of decay.

Of the other places mentioned in the deed, little information is obtainable. Kuduhara is said to be the ancient name of the district now occupied by the Collar lake.

The local tradition states it to have been formerly inhabited by certain Bramins, who became so wicked that they provoked the divine vengeance, and were destroyed by the God of fire. One virtuous Bramin alone, and his wife, received timely warning to fly, the remainder were all burnt up, and the earth sank to the depth of 24½ cubits: in proof of which it is asserted that, on digging in any part of the lake during the hot weather, the soil displays signs of the action of fire. This may refer to a volcanic phenomenon having caused the subsidence of the tract.

Vidanur palli has not been recognized, but mention is made of Chinnapakur in an ancient MS. account of the district of Condavir, forming part of the Mackenzie Collection, and noticed by the Reverend Mr. Taylor in his 4th Report at vol. ix. p. 13 of this Journal. At p. 12 of the MS. it is stated that Bala Bhaskara Deva of the Gunapati race, made a grant of 360 kundees of land, to the Bramins of 12 gotras in Chinnapakur or Kurupadu, and gave it the name of Muppala, in the saca year 1056 (?). And again, at p. 18, in a list of villages which have a Samprati or Curnum of the Balikuruwar race and Sandilya gotra, it occurs in the following order.

Gundala.
Velanadu.
Betpudi.
Narayanpuram
Chinnapakur
Muppalapudi.
Gollapadu.
Munagapadu.
Buckapuram.

Chitraratha is a title of the sun.* It occurs as the name of one of the Pandyan Dynasty of Madura.[*] What particular deity is designated by Chitraratha Swami, seems doubtful, some consider it a designation of Siva, others of a Jain divinity.

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* Wilson's Dictionary in verb.

VII.—*Note on the Defaced state in which the Statues of the Jains are now generally found, as connected with the persecutions and overthrow of that People.—By Lieut.* T. J. NEWBOLD.

The mutilated state in which the statue presented to the Society, and others surrounding it, were found, bears silent testimony to the rancorous spirit with which the Brahmins and Jangams persecuted the Jains; and which impelled them, as we are assured on the testimony of many native writers, to wreak their vengeance, unglutted by the overthrow and expulsion of the rival sect, upon their senseless temples and images, and to do their utmost to obliterate every trace of the heretical creed from the face of the earth. In various localities that I have visited in Mysore, the Carnatic, the eastern portion of the Southern Mahratta Country, and the Nizam's territories, the Jaina *bastis* have been converted into temples consecrated to *Mahadeo,* the *Lingum,* &c. The most prominent distinguishing marks of their origin are commonly obliterated; but it frequently happens that some small bas-reliefs of the Jaina *Tirt'hankars,* or of the female effigy canopied by the uplifted trunks of two elephants, have either escaped notice, or been permitted to remain from their insignificance, sufficiently indicative of the religion of the builders. The larger and detached images are either destroyed or disfigured; and thrown outside the walls of the place. The Brahmins, even at the present day, declare it to be unlucky to look upon the countenance of a Jaina image: consequently the features of the statues have rarely escaped mutilation or destruction.

At Bagwari in the Southern Mahratta Country, near which place *Basava,* the celebrated founder of the Jangam sect, and subverter of the Jaina kingdom of Kalyan was born, are many marks of the furious spirit of extermination: the numerous Jaina temples have, with two exceptions, been levelled with the dust, and their remnants, in the shape of broken altars, and elegantly carved pillars, employed in repairing the walls of the town. One of the two *bastis* left standing has been converted into a temple to the apotheosis of the arch prosecutor of the Jains—*Basava*, and the other into a manufactory for earthen ware. Similar evidences of this spirit are visible among the ruins of Annagundi, Bejanugger, and at Courtney, in the Ceded Districts. The latter, now an insignificant village, was formerly a place of importance under *Jaina* ascendancy: one of its principal *bastis* is occupied by the sacred feet of the Indian Mars—*Comarswami*—images of the god *Ganesa*—the goddess *Parvati*—the bull and *Lingum*. Another has been converted into a mosque by the Mahomedan followers of Hyder and Tippoo, and a third forms the *Math* of a Jangam priest. The large image of one of the *Tirt'hankars*, is seen cast outside the western gate, disfigured in the usual manner, and the lower extremities buried in soil. The destruction and defacement of the Jaina inscriptions on stone, and substitution of others in their room, are much to be lamented, and I would strongly urge the Society to direct its attention towards the copying of all such as still exist in various parts of the peninsula, before it be too late. The rancour of the Jangams and Brahmins towards the Jains still exists in smothered, though unaltered, bitterness. The copies should be taken, if possible, by means of Jaina scribes in order to avoid forgeries, alterations, or interpolations. The indefatigable and successful exertions of Mr. Walter Elliot have already gone far to place the history and chronology of peninsular India, on a surer and more solid basis than hitherto, grounded on the chronicled and unbiassed information contained in 595 inscriptions on stone and copper, collected in various parts of the Southern Mahratta Country, Mysore, the Nizam's dominions and Sunda.* It is scarcely necessary to remark how extremely valuable such information is, gathered from these mile-stones of time's course; and that a wide field still remains untrodden to all who, imbued with a liberal zeal for the advancement of knowledge, enjoy similar opportunities of collecting it.

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[*] Prinsep Us. Tab. ii. 121.

Although the Jains were not able to defend their temples and larger statues from profane hands, they contrived to carry off the smaller images, and many of their sacred books, which they preserve with the jealousy natural to the weaker sect. The smaller images that I had opportunities of seeing in Canara and the Southern Mahratta Country, were all either of brass or a white slightly veined† marble, which is said to be brought from the *Uttara Des*, or country north of the Nerbudda, and represented the twenty-four *Tirt'hankars*, both singly and in groupes, in their peculiar standing or sitting-at-ease postures. The

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* Vide Madras Journal, vol. 7. p. 193.

† Marble appears to be a sacred stone among the Jains, being always preferred when procurable, and is sometimes brought from great distances.

Jaina colossal statue of *Gomúta Raya* on the rock of *Sravan Belgola*, in Mysore, said to be 70 feet 3 inches in height is of granite. The Duke of Wellington, who visited it, was of opinion that the rock had been cut down until nothing but the image remained. This opinion I found corroborated by the testimony of the priests and natives of the locality, and the truncated shape of the rock on the summit. The jealousy of the Yaitis permitted only a cursory examination of the base, which has every appearance of having been cut down to the plane on which it rests, and was probably one of those prodigious blocks, frequently seen as tors and logging stones on the granitic elevations of peninsular India. In gazing on the gigantic proportions of this colossus, and the hill constituting its base, from the plain below, one cannot avoid being reminded of the story of Dinocrates the sculptor, proposing to cut down mount Athos into a stupendous statue of Alexander, holding a town in his left hand, and in the right a large basin to receive the streams issuing from the mountains sides.

Another Jaina statue in granite, of the same personage, though of inferior dimensions, occurs at Carculla, in Canara. It is said to be thirty-eight feet in height*, and to have been sculptured A. D. 1431. Both have hitherto escaped destruction, and possibly owed their safety to the superstitious feeling of veneration, which objects of great magnitude, woudrous art, or strange deviations from nature, rarely fail of inducing in the minds of all Hindus, without reference to caste.

I have already mentioned that the religious statues of the Jains are either in one erect or sitting posture: they are generally naked, and in attitudes betokening a state of repose, consistent with the metaphysical ideas entertained by this sect of a state of future beatitude; or of the profound abstraction and meditation on things divine, essential to the perfect attainment of that state. To this circumstance, superstitious adherence to ancient models as well as to the operation of the *beau ideal* of Hindu sculptors, which is highly unfavourable to the demonstration of the finer shades of anatomical development, and the expression of mind by its action upon the features, may be mainly attributed the tame and insipid character of their single statues, so odious to eyes that have been accustomed to look upon the exquisite productions of a Praxiteles, Chantrey, or Canova. The same causes prevented the Egyptians, from rising in the art of sculpture; who, we are informed by Mr. Wilkinson, even at the latest periods continued to follow the imperfect models of their early artists, and grace and feeling were for ever prevented from forming a feature of their sculpture: and though they made great progress in other branches of art, though they evinced considerable taste in the forms of their vases, their furniture, and even in some architectural details, they were for ever deficient in the combination of ideal beauty with the natural position of parts in the human figure. One great impediment to the advancement of the statuary's art in Egypt, was the unvarying posture of the figures, which were always in a state of repose, or in a position that only required the limbs to be straight, without any attempt at action, or indeed any indication of life: "all was made to conform to the same invariable model, which confined the human figure to a few conventional postures." Such are a few points of resemblance common to the productions of Jaina and Egyptian statuaries; which, had not a vile superstition pressed like an incubus on their rising improvement, would have anticipated in excellence and beauty the most exquisite sculptures of Greece. The Jaina statue now presented, was taken from the ruins of Bijanugger, and is doubtless that of *Pareswanath* from the attitude, contour, and serpent folds behind the back of the image. *Pareswanath* is the 23d *Tirt'hankar* of Jaina mythology, and is often represented with the cobra di capello canopying his head with its extended hood: not as a symbol of eternity, but from some circumstance connected with the history of this saint, recorded in his *pura'na.*

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* One foot less than the celebrated statue to Minerva, of ivory and gold in the Pantheon at Athens, by Phidias.

Subjoined is a list of Jaina MSS., now extant in the peninsula: which, if not already before the public, or among the Mackenzie papers, it would be advisable to procure copies of. The list was given me by a Jaina priest of Talicota, in the jaghire of the Mahratta chief, Rastia.

1st. The *Siddhanta Sastra* which proceeded from the mouth of *Ardenath* himself, the first of the last twenty four *Tirt'hankars,* written by *Gautam-Muni,* in the *Ghata Bhasa,* and afterwards compiled in Sanscrit, Canarese and Mahratta. This is considered the most sacred of their books.

2d. The Siddhanta Purána.

3d. Naga Komara.

4th. Herri Womshu.

5th. The twenty-four Puránas, of the twenty-four last *Tirt'hankars.*

6th. The Jaina version of the Ramayana.

7th. Vijaleng Purana.

8th. The Manter or St'hoter of Bhagwant, the Jaina ritual.

The *Hari Vansam* is equivalent to the *Mahavansu*, and is supposed to be a version of the *Mahabharat*. The *Vejaleng purána* is the history of *Vejala*, the Jaina king of *Kalyan*, and the rise of the Jangam sect. The *purának* of the first twenty-four *Tirt'hankars* or deified saints, are not procurable.

VIII.—*On an error in Dr.* THOMSON'S *Mineralogy.*—*By Captain* J. CAMPBELL, *Assistant Surveyor General.*

In mineral analysis magnesia is one of the most difficult earths to precipitate. It has the peculiarity of forming a great many soluble double salts, and even its carbonate is partially decomposed by cold water, so that a portion is taken into solution. These double salts appear not to have been examined with sufficient attention by chemists; Rose in his Manual of Analytical Chemistry remarks that, in precipitating magnesia as a carbonate, carbonate of soda cannot with equal good consequences be employed instead of carbonate of potash,—carbonate of magnesia, according to Mosander, forms with carbonate of soda a double salt, this salt is decomposed, neither by boiling the solution, nor by evaporating it to dryness; while on the contrary the analogous double salt, containing carbonate of potash and carbonate of magnesia suffers decomposition thereby. The wash water also dissolves much more of the double salt containing soda, than of the simple carbonate of magnesia, yet, for all that, were carbonate of soda employed to separate magnesia, a great excess would be obtained in the analysis. Dr. Thomson says, "the employment of carbonate of soda, in-" stead of carbonate of potash, has also a tendency to prevent the for-" mation of the double salt, for soda-carbonate of magnesia, does not " form nearly so readily as potash-carbonate." The easiest, and readiest mode of precipitating magnesia, is from the ammonio-muriatic solution, by adding an excess of ammonia, and then adding phosphate of soda, when an immediate precipitate of ammonio-phosphate of magnesia is thrown down. This salt is almost insoluble in cold water, and therefore this method is the best, and readiest in a rough quantitative analysis, such as is desirable in the present state of our knowledge of our Indian minerals. But unfortunately we are precluded from using it, because chemists have not yet decided on the composition of the precipitate. Rose says that after being ignited, it contains 36.67 per cent of magnesia, but Thomson says that it contains only twenty-two per cent. In this, however, it would appear, that Dr. Thomson has made a mistake, because he says that caustic ammonia, and phosphate of soda, also biphosphate ammonia, give the same precipitate; but this is impossible, because in using caustic ammonia and phosphate of soda, there is only *one* atom of the acid, which combines with one atom of ammonia, and one of magnesia, to form a subphosphate; and, after ignition, the ammonia having been volatilized, there will remain a neutral phosphate of magnesia, which, according to Dr. Thomson's table of atomic weights, will contain 35.7 per cent of magnesia, which is not much different from the proportion given by Rose. But if biphosphate of ammonia is used, in case the solution does not contain an excess of ammonia, two atoms of the acid will be present, one of which will leave the ammonia, and take up an atom of magnesia, and form a double neutral salt, and not a sub-salt as before. On igniting this precipitate, an atom of the ammonia being volatilized, there will remain a biphosphate of magnesia, containing 21.7 per cent of magnesia. We may therefore conclude that Dr. Thomson has been in the habit of using biphosphate of ammonia always as a precipitate, and that there are *two* insoluble double salts of phosphoric acid, ammonia, and magnesia. Dr. Thomson after giving the composition of the ammonia-phosphate of magnesia in his chemistry, remarks—"Riffault analysed an ammonia-" phosphate of magnesia, which would seem to have contained only " half the phosphoric acid in the preceding salt." It contained one atom of diphosphate of ammonia, and one atom of diphosphate of magnesia, which must be the very salt to which Rose alludes. I am informed that Brande, in his chemistry, mentions there are two salts of this kind, and one is composed of

Ammonia	1 atom.
Magnesia	1 atom.
Phosphoric acid	1 atom.
Water	5 atoms.

but between this Riffault's salt, there is a discrepancy—for this, Dr. Thomson says, is composed

1 atom.......of........diphosphate magnesia.
1 atom.......of........diphosphate ammonia.
5 atoms.......of........water.

which is equivalent to

2 atoms.......of........magnesia.
2 atoms.......of........ammonia.

2 atoms.......of........ phosphoric acid.
5 atoms.......of........ water.

Therefore Riffault's salt contained only half the water that Brande's did.

There are points, which if cleared up would be of the greatest service to mineral analysis. How many there are in India, who have ample leisure to devote to such pursuits, and the apparatus required is quite trifling, and might all be packed in a bullock trunk. With all the activity of chemists in Europe, there is still a great deal of work to be done; there are many salts the composition of which has never been examined, and which require no very wonderful stretch of ability to analyse. Why then cannot it be done in India as well as in Europe. Mr. John Griffin, the translator of Rose, in a little work entitled "Chemical Recreations," which is in fact a most excellent treatise on operative chemistry, remarks that "No practical chemist, however young "he may be in the science, can pursue his studies with even a moderate "degree of zeal, without being enabled to add something almost daily "to the existing stock of knowledge. The variety of unrecorded facts "which continually strike the eye of an industrious experimenter is "indeed surprising." Again.—"The notion that a laboratory, fitted "up with furnaces, and expensive and complicated instruments, is an "absolute requisite for the proper performance of chemical experi-"ments, is exceedingly erroneous. In fact the truth is quite opposed "to this opinion."—"For general and ordinary chemical purposes" "says Dr. Henry "and even for the prosecution of new and important "enquiries, very simple means are sufficient: some of the most inter-"esting facts of the science may be exhibited and ascertained, with "the aid merely of florence flasks, of common phials, and of wine "glasses. In converting these to the purposes of apparatus, a consi-"derable saving of expence will accrue to the experimentalist: and he "will avoid the encumbrance of various instruments, the value of which "consists in shew, rather than real utility. It is a curious and in-"structive fact, that some of the most important discoveries in che-"mistry were made by persons who, either from choice or motives of "economy, used utensils of the very simplest characters. The labora-"tory of the great Priestly cost a mere trifle; and it is well known "how savingly Franklin went to work. The student will beware of "procuring the large and showy apparatus which strike his eye from "the lecturer's table, for they are useless to him." These remarks from a man of Mr. Griffin's practical experience, are encouraging enough to the chemist in India, and shew how true the old adage is. "Where there's a will, there's a way." The Laboratory of Dr. W. Prout, one of the first chemists of the present day, was a carpetted sitting parlour; his laboratory table, a mahogany writing table, and his furnace the parlour grate.

IX.—*On preserving Timber, &c. from the destructive attacks of the White Ant.—By Aliquis.*

The well known effects of corrosive sublimate in protecting objects of Natural History from the attacks of insects, induced me to make a trial of its power of preserving timber, carpets, &c. from the destructive inroads of the white ant,—and I am happy in being able to say that the experiments I made were perfectly successful, and justify the hope that, by the means now recommended, we shall soon drive these destructive insects from our houses—or at all events render their visitations comparatively harmless.

The strength of the solution I used, was one ounce of the corrosive sublimate to one gallon of water, having previously rubbed the mineral up with a little alcohol to increase its solubility;—wood was immersed in the solution for one week, but carpets and cotton cloth were allowed to remain only for two days. The experiments I varied in every possible way—and uniformly obtained the same result, viz., that the white ant will but very partially, if at all, destroy the substance of any thing macerated in the solution, and that, on discovering its nature, they immediately disappear.

With woollen cloth the effects were less decisive, as the solution appears to be unable to penetrate the fibres of the wool, and is partially removed by washing—but under cotton carpets, rush mats, &c. the insects will burrow for the first day or two, and then disappear; and with regard to timber they are even more fastidious, as I have observed in their covert ways, that they had placed a coating of earth between themselves and the wood; evidently anxious not even to come into contact with the poison.

The advantages of preparing wood in the way recommended, are not, however, confined to its immunity from the attacks of the white ant—as it is now generally known that the same preparation (Kyan's patent) effectually resists dry rot, or other decay; and from the power it is known to possess, of coagulating the albumen contained in the wood—and indurating the fibres of the softer and cheaper varieties of timber, and rendering them immediately fit for use, if cut down even in a state of active vegetation, are circumstances well worthy of public attention. The method, I believe at present adopted, for preserving the wood of public buildings from attacks of the white ant, is by the application of mineral oil; and its effects are but temporary, as it appears to depend upon its disagreeable odour—as it is only by the repeated renewal of the application that the wood is protected—but by using in its stead a solution of the muriate of mercury—no repetition of the process would be necessary—either to guard against the destructive effects of time, or the more sudden and injurious inroads of the white ant.

Its power over cloth is equally beneficial, and it has been found a perfect preservation against mildew.* As few tents become unserviceable from the simple wear and tear of use, I feel assured if the outer cloth alone, where the decay almost invariably begins, were steeped in the solution, it would, at a very trifling expence, add many years to its durability.

With reference to the question whether such an active agent, as we know muriate of mercury to be, could be so extensively used with impunity, and whether would it not, by becoming volatilized, impregnate the atmosphere of the rooms or tent with poisonous qualities, I am not able from personal experience to reply; but, from experiments which have been made to ascertain that point in England, I do not conceive that any injurious consequences would result from its use—more especially when applied to timber, cotton carpets or tent cloth, as the effects of the mineral upon both of these substances is to enter into chemical combination with them—and repeated washing in no ways diminishes its preservative power. In support of that opinion, I may mention that a vessel was built in England entirely of timber, prepared in the above way, with the sails and cordage also steeped in the solution, and that no inconvenience was experienced by the workmen in preparing the materials, or in building the vessel, or by the crew who inhabited her after she was finished.

The above remarks make no pretension to originality; the subject is one which has excited much attention in England, although I am not aware that it is one generally known in India. In submitting them I have been only anxious to give a knowledge of the facts more extended circulation, in a country where decay of property is so general and so rapid, from causes which muriate of mercury possesses the power of counteracting.

Madura, 1838.

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* Vide *United Service Journal* on Kyan's patent.

X. —*Notes illustrative of the Geology of Southern India.—By Lieut.* R. BAIRD SMITH, *Bengal Engineers.*

The universal prevalence of primary rocks, with the general quiescence of the agents of active reproduction, tend to give a degree of monotony to the geology of Southern India, and to deprive it of that interest which naturally attaches to activity and variety. The features of its hills and its valleys alike exhibit indications of the long continued reign of the decomposing and abrading powers of the natural world. The fantastic turret-like peaks, the results of the unequal disintegration of the granitic masses of which they are composed, so frequently crowning the summits of the one, are the trophies of ages of resistance on their part to atmospheric encroachments, while the boulder-like masses and crumbling deposits met with in the other, tell the same tale of long resisted but yet resistless power. But amid these signs of decay we see nothing of those active reproductive agencies which so abundantly characterise more diversified regions. No great rivers are seen bearing on their waters the fragments of one continent to re-create or increase another; no inland lakes or seas are gradually passing away from the face of the earth, year by year perceptibly approaching the time when fruitful fields will replace their "waste of waters," and when their solitude and silence will yield to the glad voices of the labourers rejoicing in the luxuriance of these new born lands.

Equally quiescent are all igneous agents, for no volcanoes are here in active operation, and the existence of subterranean forces is only occasionally indicated by slight tremblings of the earth within very limited districts. Yet even with this monotony, the geology of Southern India is not devoid of interest, since its very peculiarity in having been so long free from any powerful disturbing agents, either aqueous or igneous, has admitted of the full display of those phenomena which result from the unchecked sway of the decomposing influence of atmospheric agents. These are neither trivial nor uninteresting, since to this source there seems now but little doubt that the formation of the laterite, so long an apple of discord among the observers of Southern India, is to be traced. A mass of observations gleaned from many well developed lateritic localities, both on the coast and inland, have recently been made public in an interesting paper on this formation by Dr. Clark, H. M. 13th Dragoons; and by the careful examination and discussion of these, the question of its origin seems to me to be satisfactorily answered. Before this paper came to my knowledge, a conviction that the laterite was the result of the aggregation of the decomposed constituents of the rocks which it usually overlies, was forced on my mind by observations in several of those identical localities whence I find Dr. Clark has gathered a considerable portion of his information; and it was with pleasure that I found a conclusion, based on limited data, supported by an examination so extensive and so ably conducted as that of Dr. Clark. In the vicinity of Bangalore, where both the lateritic and lithomargic formations are largely developed, an opportunity was afforded me of studying them in detail. Many of the protruding masses of sienitic granite and gneiss, which are the prevailing rocks, exhibit nature as it were in the simultaneous acts of decomposition and aggregation. Their surfaces are usually covered with a coating of dark coloured and weathered matter resulting from the felspar or hornblende, studded with small undecomposed and ferruginous pebbles of quartz, while round their bases the laterite forms a regular talus of variable size. It is usually of the compact quartzose and distinctly marked variety: sometimes however it assumes the cavernous or vesicular structure, the dark red matrix exhibiting a series of small cavities. One example was of peculiar interest, for, in consequence of the existence of a basin-shaped hollow in the side of the rock, the materials necessary for the formation of the laterite had collected there and a small nest of it formed. The circumstances of the case excluded from consideration both the aqueous and igneous causes, whose aid has usually been called in to explain the origin of laterite, and the clear evidence of its being due to the slow but certain operation of atmospheric agents amounted to demonstration. The bewildering effect of a multiplicity of contending opinions, gives to such simple yet well marked observations on the point at issue, additional value and interest.

As the resultants of decomposition, it is natural to expect that the character and composition of both laterite and lithomarge will be very variable, since the constitution of the parent rocks will necessarily influence that of the derivatives. Hence it has been found by observation that those rocks in which the proportion of quartz to felspar and hornblende is considerable, decompose into laterite, while those in which quartz is less abundant usually exhibit the lithomargic character. The same specimen sometimes presents both of these formations, the one passing imperceptibly into the other, and clearly establishing the position that they are effects of the same cause modified by concomitant circumstances. These circumstances are externally the variations of heat and moisture, and internally the greater or less degree in which the constituents of the rocks predispose them to be affected by the oxidising influence of the atmosphere. Throughout nearly the whole of Southern India sienite prevails, and with it laterite is very generally associated. But sienite contains hornblende as one of its principal ingredients, and the large quantity of oxide of iron this contains peculiarly disposes it to yield to atmospheric action. Hence then follows the disintegration of the mass; the felspar furnishes the alumina necessary for the matrix, and the quartz resisting decomposition, and becoming ferruginous from the infiltration of the iron, forms the imbedded pebbles, and thus a laterite results. Dr. Clark from his own observations has subdivided the laterite into three classes, the lithomargic, the quartzose, and the detrital. The first is distinguished by the large quantity of lithomargic earth present in it, which deprives it almost wholly of tenacity, and gives it a cavernous appearance; the second, by containing numerous rounded pebbles bound together by a clayey cement, occasionally also cavernous; the third, by being merely a congeries of pebbles not firmly aggregated, but yet exhibiting the features of laterite. My own observations induce me to believe that this classification will include nearly the whole of the varieties of this very variable formation, as I have never met with any prominently beyond its range. To Dr. Clark's most interesting paper* I would refer those, who may wish to see the grounds, on which the present theory of the formation of laterite rests, fully illustrated; my sole intention in alluding to it having been to confirm the accuracy of his observations on those localities which we had similar opportunities of examining, and to contribute my limited store of facts for the elucidation of a point which has so long engaged the attention of geologists.

The depth to which the decomposing influence of the atmosphere will reach, even through the solid rock, is well exhibited when sections are exposed in excavations, an opportunity was afforded me for observing during the sinking of a shaft for a mine in the vicinity of Bangalore. The lithomargic earth commenced at eighteen inches or two feet from the surface, and, as the excavation proceeded, the sides of the shaft exhibited it beautifully variegated in colour. At about 15 feet it began to get slightly more tenacious, and the felspar appeared as white earth. Gradually to the depth of 20 feet, the rock approached nearer and nearer to its natural undecomposed state, though even at that depth it was still crumbling. When the excavation ceased at about 22 feet, the rock seemed to be pegmatie, as nothing but quartz and felspar were distinguishable, and, judging from its appearance, the atmospheric action had probably reached a farther depth of 8 or 10 feet, making in all from 30 to 35 feet of solid rock penetrated by this destroying power.

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* Madras Journal of Science, December, 1838.

It may be mentioned as an interesting fact, that the contents of the excavations in this vicinity were frequently auriferous, and small quantities of gold were obtained by washing. This is by no means an unfrequent occurrence in the Mysore country. In blasting sienite at Chinapatam, a village about 40 miles from Bangalore on the road to Seringapatam, I occasionally observed considerable quantities of gold disseminated in small particles over the fractured surfaces; and, at one time, in the vicinity of Wynaad, this metal was obtained from a rich yellow earth, in quantity sufficient to employ a number of labourers, and to yield some return.

Travelling eastward from Bangalore towards Oossoor, the country presents but little either of natural beauty or scientific interest. The beds of the nullahs occasionally exhibit a variety of laterite, whose formation seems to have been materially due to the transporting agency of water. The prevailing rock being the sienitic granite, its decomposition has supplied a large quantity of quartzy pebbles, which are strewed over the fields in every direction. A rush of water after heavy rains transports these to the adjoining nullahs, whose clayey bottoms form a matrix in which they become imbedded, and during the dry season the whole hardens into a compact mass, exhibiting the characteristics of one of the varieties of the laterite. Detached and water-worn fragments of the other varieties were occasionally met with, but no extensive deposits were observed in situ.

The hills in the vicinity of Oossoor were found to be composed of the universal sienite, exhibiting occasionally with the addition of mica the striated appearance of gneiss. Large veins of pure white quartz and dykes of greenstone traversed the main rock in different directions, without however having caused any alteration at the planes of junction. In many places the sienite had completely decomposed the hornblende into a dark red impalpable earth, and the felspar into a similar white one; the quartz was in ferruginous pieces, undecomposed, with highly vitreous lustre and splintery fracture.

Passing from Mysore into the Barramahal district, the primary rocks still prevail. The features of the adjoining country are now, however, altered, and the comparatively flat and uninteresting plain is exchanged for mountain scenery at once bold and beautiful. Lofty and precipitous hills rising abruptly from the plain, sometimes clothed with rich verdure and covered with trees and shrubs to their summits, at other times presenting scarcely one solitary green spot to relieve their desolate and rugged nakedness, bound the view on every side, and the traveller, following the road which winds along their bases, passes through a series of valleys where, kaleidescope-like, each turning brings new beauties before him. On approaching Kisnagherry, the principal town in this district, the distant hills occasionally exhibit the ribbed-like appearance characteristic of columnar basalt. The town itself is overhung by one of these, but an examination of it, effected with considerable difficulty and risk, proved that the ribbed appearance was due, not to the existence of columns, but to linear deposits of earthy and fungoid matter, the dark colour of which, alternating with the natural colour of the rock, produced when viewed from a distance exactly the effect of a columnar arrangement. These deposits were formed along the lines by which little streamlets of water trickled down from the summit of the hill, these having doubtless led to the partial decomposition of the rock, and the formation of soil sufficient for the fungi to vegetate in. Nests of hornblende and greenstone were abundantly met with, and the whole of the sienitic mass was traversed by veins of pure quartz.

The cause of the constant occurrence in primary formations of these segregations of simple minerals in the rocks of which they form constituent parts, is a most interesting, but as yet unsolved question, and one attended with peculiar difficulties when experimentally investigated, from the circumstance that the phenomena in question require periods of such extent for their development, as to make it impossible to institute in the laboratory any experiments which would be strictly, and in all points analogous to what obtains in nature. In their original state of igneous fluidity, the operation of the attractive affinities of the molecules of which the different minerals forming granitic rocks are composed would be free and uninterrupted, as has been satisfactorily shewn by the "pyrochemical" experiments of Maesterlich, and others, who have succeeded in obtaining crystals of the minerals alluded to, from the igneous fusion of their constituents. But, the obtaining of these in their crystalline state, only as detached and individual substances, leaves us still in doubt as to the causes of some of them occurring massive and disseminated. Thus, among others, a curious and most interesting fact stated by Mr. Babbage in his "Economy of Machinery," appears to warrant the conclusion, that such segregations take place when the substances are in a state of aqueous fluidity; for he remarks, "Flints after being burned and ground are suspended in water in order to mix them intimately with clay, which is also suspended in the same fluid for the formation of porcelain. The water is then in part evaporated by heat, and the plastic compound, out of which our most beautiful porcelain is made, remains. It is a curious fact, and one which requires farther examination than it has received, that if this mixture be suffered to remain long at rest, before it is worked up, it becomes useless: for it is then found, that the silex, which at first was uniformly mixed, becomes aggregated together in small lumps. This parallel," he adds, " to the formation of flint in the chalk strata deserves attention."* Could an analogous observation to this, on the aggregation of the constituents of minerals in a state of igneous fluidity be obtained, a most important light would be thrown on their occurrence in detached and massive portions in rocks of igneous origin. In the present, as in many other instances, geology must claim this boon from the sister science of chemistry.

At Mallepandy, a village about ten or twelve miles from Kisnagherry, a beautiful specimen of epidote, of the usual dark green colour, was found imbedded in a mass of true granite, which was here observed, though not to any considerable extent. The sienite was found to be peculiarly large grained, and the crystals both of the hornblende and felspar distinctly defined; on one fragment of the rock, which had been precipitated from the higher ground, a large quantity of iron pyrites in cubical crystals was observed. The country between this village and Wanianabaddy presents the same general features, veins of porphyry outcrop at about a mile from the latter place, exhibiting occasionally small nests of chlorite. The road in many places passes over the underlying granite, which is more abundant here than usual, and the large quantity of mica scattered over its surface causes it to glitter in the light of the sun like burnished silver. Many water-worn fragments of different rocks, greenstone, basalt, compact and vescicular, reddish coloured sienite, so small grained as readily to be mistaken for sandstone, are found strewed over the sandy plain surrounding Wanianabaddy. They are brought most probably from the distant hills by the Palar river, which during the moonsoon comes down with great violence, and often devastates the adjoining country.

The aspect of the valley between Wanianabaddy and Amboor is monotonous and uninteresting. At the latter place I was much interested by the marked development of the phenomena of crystallisation in the structure of the trap dykes, which traverse the neighbouring hills in great abundance. It is unnecessary however to describe these in detail here, as I have elsewhere done so at considerable length.[*] It may therefore suffice to remark, that the trap, invariably, on being fractured, exhibited cleavage planes, and separated into obtuse angled rhomboids; that fissures traversed the dykes always at right angles to the cooling planes or sides of the including sienite; that the direction of cleavage was perpendicular to that of fissures; and that the trap was evidently altered at its planes of junction with the sienite. In attempting to trace the cause of these phenomena we are carried to the unexplored domain of modern science, for their development is dependant on the action of molecular forces, whose origin and mode of operation are alike enveloped in much mystery. Mathematical analysis[†] has been successfully employed in demonstrating that, granting certain postulates, the phenomena of crystallisation may result from the adjustment of electrical forces; and observation tends apparently to confirm such a theory, by shewing that crystals do actually result from the action of forces derived from this source. But, we are still required to apply these conclusions with diffidence, as their verification cannot yet be considered as effected. The existence of electricity during the passage of trap dykes from their original state of igneous fluidity to that in which they now exist, may safely be concluded, from the experimental truth, that variation of temperature is one of the most fruitful sources of this agent; and should it ever be satisfactorily shewn that a subjection to electric agency confers on the particles of matter that peculiar polarity, which disposes them to group themselves in determinate figures, and under determinate laws, no element will be wanting for the application of such a principle of explanation to the present case.

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* Note. Will carbonate of lime treated as above with alumina segregate similarly to silex? If it does, then may not the occurrence of layers of nodular kunkar in clay be explained on the same principle as the occurrence of like layers of flint in chalk? The question admits of an experimental reply, and an effort to obtain this is now in progress. R. B. S.

The plain of the Carnatic is diversified by the occasional occurrence of connected, as well as detached hills. A peculiar feature is to be remarked in several of those in the immediate vicinity of Vellore. Individual hills are observed to rise abruptly from the plain, like islands in the midst of an ocean of sand, of the most perfectly conical shape, and wanting only the crater, with its accompanying cloud of smoke, to complete their resemblance to existing volcanoes. These hills are usually at some distance from the connected ranges, and as an explanation of the peculiarity, it might be conceived that the upraising force had in the one case acted on a line to produce the range, while to produce these insulated and conical hills it had been concentrated in a focus or point.

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[*] "On the crystalline structure of the trap dykes in the sienite of Amboor, &c. &c." Madras Journal of Science, July, 1839.

[†] M. Mosotti sur les Forces qui regissent la constitution interieures des corps Whewell's Hist. of *Induc. Science. Sommeville Conn. of Phys. Science.*

At Palleconda, a small town about 14 miles south-west of Vellore, I crossed a tract of country which has been described by Dr. Benza, an observer who has added considerably to our knowledge of the geology of Southern India. The plain on which the town stands is sandy, and strewed over it there are many weathered masses of sienite, which natural sections, afforded by the deep nullah beds, prove to be the underlying rock of the whole. Traversing this there are as usual dykes of trap and porphyry. The latter is of a peculiar kind, the porphyritic crystals being of felspar imbedded in a matrix of quartz. Investing a portion of this quartz-porphyry, were found crystals of an ore which I am inclined to believe was specular iron ore. Its characteristics were highly metallic, inclining to adamantine; colour dark grey, nearly black; hardness between 7 and 8; fracture splintery; structure laminated; specific gravity not numerically determined, but high; crystalline form a flat rhomboid. In the adjoining hills felspar of the sienite was occasionally of a pink colour, and dendritic on the surface. Transported masses of greenstone, basalt, mica, and clay slate were found in the vicinity of the streams, though none of these rocks were observed in situ.

The country between Palleconda and Vellore, while it exhibits no variety in geological structure, is interesting from the singularly wild and beautiful character of its mountain scenery. On the summits of the hills the tor-like masses of the sienite are grouped in the most varied forms, sometimes shooting up like spires, at other times strewed around like the ruins of some extensive edifice, or again standing square and solid, like the massive walls and donjon keep of some robber chieftain's tower. The valleys are covered with similar blocks piled on each other in the wildest confusion, the whole seeming to tell of mighty convulsions, rather than of the slow and scarcely perceptible operations of the agents of disintegration and decay.

A monotonous and uninteresting plain, with but little to attract the attention of the geologist, extends from Vellore to Madras. The same sienite which forms the distant hills underlies the whole of this plain, outcropping at several points. It was met with immediately under the sand during the progress of an artesian well sunk in the immediate vicinity of Madras, which after passing some little distance through the rock was abandoned; and indeed it is singular that, considering the geological configuration of the district, it was ever undertaken at all, since it is scarcely possible to conceive one less calculated for the success of such an attempt. The immediate succession of a close grained, hard, compact, primary rock of unknown thickness to a bed of porous sand, would effectually prevent the percolation of water to any depth exceeding that of the sand itself, and consequently the formation of those interior reservoirs on which the economical value of artesian wells depends. There are no porous strata beneath the sienite, nor is the sienite itself a cavernous rock like certain limestones in which water may collect in large basin-shaped hollows; hence the attempt must have been made with but little consideration of the principles by which such operations ought to be guided, and hence also an additional motive for the encouragement of the study of a science which promises to obviate such unnecessary expenditure of materials, money, and time.—*Calcutta Journal of Natural History, vol* 1, *pp.* 183—199

CALCUTTA, *9th April,* 1840.

XI.—*Geological Features of the Himalayan Mountains.*

(*From* ROYLE's *Illustrations of the Botany, &c. of the Himalayan Mountains, Supplementary Part*).

HAVING noticed the extent and physical features of the Indian empire,[*] we might proceed to describe the materials of which its mountains and its plains are composed, as well as the soils produced by their disintegration. But the most cursory notice of the Geological features of so extensive a field would require more space than can be allotted to the subject; the Author must, therefore, confine himself to the part with which he is best acquainted, and which can be elucidated by his specimens and observations, which have attained some value from the kindness, as stated in the Preface, of his friend Mr. De la Beche. But the sections[†] can only be considered as giving a general idea of the dip, direction, and nature of the formations met with. The sections of the Himalayas correspond with that given, as far as it goes, by Dr. Falconer, in his Report on Tea cultivation, though he informs me that mine are erroneous; in the parts near the Snowy Peaks, where the Author relied for his information on Capts. Herbert and Hodgson, as, instead of consisting of gneiss, they are formed by one of the grandest outbursts of granite in the world. The sections of the Central range of India, from Sherghatty to Roghonautpore, formed by Mr. De la Beche, from the Author's specimens and observations, correspond with that previously published by the Rev. Mr. Everest, in 1831, in the third volume of the Gleanings of Science.

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[*] In the "Introduction" to Professor ROYLE's *Illustrations*,—an abstract of which will be found at page 151 of No. 18 of this Journal.—EDITOR.

[†] "*Illustrations*," Plate 1.

The great Gangetic valley consists of an extensive plain, which is very gradual in its slope from Saharunpore to the Sunderbunds, v. p. x. The structure is not easily detected, from the universal flatness, and the horizontal nature of the depositions, while water being near the surface, wells, the only works, reveal only a few feet in depth below. The surface soil is generally sandy, with a varying proportion of clay, which predominates in the substratum, and is in most places sufficiently pure for making bricks. Calcareous particles are intermixed with the soil and substratum in most parts. These in many places assume the form of spongy cavernous nodules: in some the form of stalactites or of roots, and are then apparently of modern origin; in other places they are in masses sufficiently large to be worked and used as a building stone. But the nodular appearance is the most remarkable, especially from the nodules being so abundant in some places, as to cover the soil, and give the appearance of the surface being covered as if with a fall of large hail-stones. This forms the extensively diffused *Kunkur* formation of India.

In Calcutta, in deepening a tank, a group of full-grown trees were found standing erect, and apparently lopped off, three or four feet above the roots. In boring for water, rubbish and mould were first met with, then sandy clay, and, at twenty feet, a vein of pure sand, the source of the common springs of wells. Blue clay, with sand,—then black, above a stratum of peat; with pieces of wood, that of the Soondree, and at sixty feet, Kunkur nodules; reddish well-sand at seventy-five feet, whence the river springs rise. Clays and sands, with some Kunkur, are found below this: a quicksand at 120 to 136 feet; and at 176 feet, quartzy sand and granitic gravel; and from 350 feet below the surface of Calcutta, the auger brought up a fossil bone, which is figured in J. A. S. for March 1837. At Benares, Mr. Prinsep, in cutting a tunnel and sinking shafts, found, fifteen feet below the surface, a number of half-quarried stones of a large size, on what he conceives must formerly have been the level of the ground; at thirty feet, some kunkur was met with. At Saharunpore, in digging a well, after ten feet, coarse moist sand was found, mixed with round pebbles, chiefly of quartz, and about twenty feet from the surface, pieces of kunkur or tufaceous limestone, were raised, together with dicotyledonous wood, apparently of one of the Coniferæ. At Bihut, twenty miles north of Saharunpore, Capt. Cautley discovered the site of an ancient town seventeen feet below the present surface of the country. The Indo-Scythic Coins which had been entombed in this oriental Herculaneum, Mr. Prinsep refers to the commencement of the Christian era. Capt. Cautley is of opinion that the enormous discharge of sand, clay, and shingle from the lower hills during the periods of the rainy season, are gradually causing a rise of the country skirting their base, and to this and the action of wind on sand, he ascribes the inhumation of this ancient city. The structure of the plains may also be seen in the raised hills which skirt the base of the Himalayas, and the banks of the Jumna afford a very interesting series of sections, of which the structure may be treated of either with that of the Gangetic valley or of Central India, as some of the peculiar formations of the latter seem to extend even to the beds of that river.

Proceeding from the plains of India to ascend the Himalayas, we every where meet with a lower range of hills, which have been variously denominated " the Lower Hills, the Sandstone, Sub-Himalayan or Sewalic Hills." These hills, in many parts, rest immediately upon the Himalayas, but in others are separated from them by a series of longitudinal valleys. The part with which the Author is best acquainted is the direct road from Saharunpore to Deyra and the Himalayas, through the Kheree pass, which is the broad, generally flat, stony bed of a hill stream, ascending by degrees to the crest of the pass, now much cut down, but from which there is a gradual descent to the valley or Doon of Deyra. Along this pass flows in a winding course a small stream of very clear water. On either side, and about fifty yards apart, arise the hills, and, according to the windings of the stream, are seen sometimes sloping, sometimes abrupt; in the former case, covered with vegetation, in the latter, presenting a barren and precipitous display of their stratified structure. These strata dip to the N.E. or towards the Himalayas, at various angles from 20° to 38°, and the hills display every variety of appearance, partly from the destroying effects of water on so destructible a material, and partly to this being sometimes defended from its influence by a covering of a boulder stone. They are formed by a succession of parallel ridges, abrupt towards the plains, and sloping towards the Himalayas. In many places, each hill, if separated, might be represented by a right angled triangle, the base resting on the pass, the perpendicular facing towards the S.W., and the hypothenuse sloping towards the N.E., and corresponding in dip with the strata. This side is sometimes continued to the level of the pass; at others, another hill, with its perpendicular side, seems to arise from the middle of the last, and is itself, in like manner, succeeded by a third, forming a succession of abrupt and sloping sides, like the teeth of a saw. At Hurdwar, the sandstone character is complete, and the rock is sufficiently hard to be used as a building stone. About fifty or sixty feet were cut through to make a road between the river and the hills, by Capt. De Bude, of Engineers, at the back of whose house, on the Hill, rolled stones might also be seen lying upon the sandstone. These hills are composed of a series of clays, of a loose-grained sandstone, with much mica interspersed; beds of gravel and rolled stones, which consist of the debris of every variety of rock: as granite and trap-rocks, limestone and clay-slates, gneiss, micaceous and hornblende schists; in fact, of all the rocks of which the Himalayas are composed. Carbonate of lime is interspersed throughout the formation, forming stalactites and encrusting leaves, &c. Carbonate of soda is also found effloresced in many situations. In some moist situations the boulders are sometimes so soft, that quartz crumbles in the hands more easily than a piece of sugar.

The gravel and boulders found on these hills are very extensively diffused. They are abundant in the series of longitudinal valleys which are bounded to the S.W. by the Sandstone range, and on the N.E. by the Clay-slate formation of the Himalayas. These have been enumerated by Capt. Herbert as the Mokowala or Ropur, Pinjore, Kyarda, Deyra, and Patle, all between the Sutlej and the Gograh, and again, that of Chetuan, which lies to the north of Bettiah. They are from twenty to twenty-five miles in length, and of variable breadth, the widest being about fifteen miles. They have two outlets for their drainage, and their highest level is usually near the middle. The surface is level or undulating, intersected by ravines, or river beds; the rock is seldom seen, except on their boundaries. The soil of the Deyra Valley, in most of the uncleared parts, as well as in many of those long cultivated, is intermixed with these rounded pebbles and boulders, which are also found at great depths. In the well dug by the Hon. Mr. Shore, they were brought up from two hundred and fifty feet; but I observed that those from the greatest depths were angular, and composed of clay-slate and limestone similar to that of the nearest, or Mussooree range; but like the shingle of the Sandstone range, or that found in the beds of rivers, they are usually composed of every variety of rock. Though so deep in the centre of the valley, the debris thins off towards its extremities, where the sandstone is seen underlying the beds of shingle; these boulders are also found filling up the valleys of the great Himalayan rivers, as those of the Ganges, Jumna; Tonse, Pabur, where flat terraces of considerable extent, sometimes cultivated, may frequently be seen, composed chiefly of great masses of boulders, with gravel and sand, with the river flowing at some depth below the flat terrace, and through which it appears to have cut its way. These exactly resemble the boulders in the channels of the rivers, or those found in the longitudinal valleys, or on the Sandstone hills, and may be traced, but smaller in size, to considerable distances: that is, to twenty or twenty-five miles in the plains, as may be seen in digging wells. They would be displayed in the same way as the Sandstone, or Sewalic range, if any portion of the present plains were by any means to be raised from their horizontal into an inclined position.

This Sandstone range may be traced along the plainward base of the Himalayas, from Roopur, on the Sutlej, to the foot of the Siccim Hills, in lat. 26½° long. 88½°, where it was recognized by Capt. Herbert, in his trip to Darjiling. Dr. Buchanan, in entering Nepal in long. 85°, describes the Hills as composed in general of clay, intermixed with various proportions of sand, mica, and gravel, disposed in strata, either horizontal or dipping towards the north, at an angle less than 25°, and that incrustations are abundant, from the deposition of calcareous matter, also lignite. The prolongation of these Hills from the Kalee to the Sutlej, or from long. 80½° to 76½°, has been minutely examined by Capt. Herbert, when employed on the Mineralogical Survey of the Himalayas, and their structure found to correspond with what has been described, and lignite found throughout. The dip is usually to N. E.; at Chikoom S. W.; but between Chilka and Dikoolee the beds are almost horizontal. At Hurdwar and Chandneepuhar, on opposite sides of the river, the strata dip in opposite directions. On the N. E. side of the Deyra Valley, in ascending to Mussooree, by Beejapore, I found the sandstone dipping S. W., at an angle of 25°, and at Kalsee sandstone is also observed dipping to the S., and gradually passing to a dip E. by N. Capt. Cautley has observed, that though we may, on a large scale, lay down the dip and direction with accuracy, the former as varying from 15° to 35°, and the latter from N. E. to. S. W., local details give very different results, and that near Nahun the mass of mountains have been upheaved from a variety of centres, as if the upheaving power had been exerted irregularly over the face of the district. He has observed a section which gives an anticlinal point under the village of Derria, on the Murkunda river. My observations also give irregularity of dip in the mountains in the vicinity of Nahun.

The elevatory force does not any where appear, by which these hills have been raised from the horizontal position in which they must have been deposited, into their present inclined one; but Dr. Falconer and Capt. Cautley have both seen appearances of trap in the neighbourhood of these disturbances. My specimens and observations indicate its vicinity on the northward of Nahun; also in the vicinity of Kalsee, and in the ascent to Mussoree by Kuerkoolee. The nearest points to the southward where indications of trap are seen, are in the bed of the Jumna, and one of these is alluded to by Col. Sykes (Proc. Geol. Soc. Jan. 1832), when tracing the trap formation to the north, which I observed in a small island called Oudhar, below the village of Kuttea, and about three or four miles higher up the river than the Seeta Puhar, and about thirty miles above Allahabad, and therefore near Mhow, which is twenty miles below Murka, the two localities where volcanic rocks have been noticed by Mr. Dean, in the Journal of the Asiatic Society.

These hills have, however, in the last few years, attained great celebrity, from their containing one of the most extensive deposits of Fossil remains, which has any where been discovered, and which have been made public by several officers of the Bengal Army, whom I am proud to call my friends: as Dr. Falconer, my successor at Saharunpore; Capt. Cautley, Superintendent of the Doab Canal; Lieuts. Baker and Durand, of the Bengal Engineers, in a series of excellent Papers in the Researches and Journal of the Asiatic Society of Calcutta, and in the Transactions of the Geological Society of London. To the two former, this Society, the fountain of Geological honours, awarded two Wollaston Medals, in February 1837, for their discoveries in Fossil Zoology, especially as displayed in their description of the *Sivatherium giganteum*,* a huge Ruminant, which, they conceive, serves to fill up the blank which has always intervened between Ruminant and Pachydermatous quadrupeds, for it combines the teeth and horns of the former with the lip, face, and probably proboscis, of the latter. Lieuts. Baker and Durand are entitled to hardly less credit, for their Papers on the Fossil Horse, Hyæna, Bear, &c., and for having had the skill to detect, and for being the first to have the boldness to publish, in their Paper in the Journal of the Asiatic Society of Calcutta for November 1836, the discovery of Fossil Quadrumana. This was two months previous to the presentation, on the 16th January 1837, to the Academy of Sciences at Paris, of a Memoir, by M. Lartet, respecting the discovery of the lower j aw of an ape, in the tertiary fresh water formation of Simorre, Sansan, &c. in the department of Gers, in the south of France, and at the foot of the Pyrenees, and which in its genera so closely resembles that of the Fossil Sewalik Hills, found, it is curious, in the district of Sirmore. These dates are adduced, because Dr. Buckland, in the Supplementary Notes to his Bridgewater Treatise, has announced M. Lartet as the first discoverer of Fossil Quadrumana. It is highly creditable to the Bengal Army that the only four officers in that part of the country should each and all have so highly distinguished themselves, in a science foreign to the pursuits upon which they are employed by the Indian Government, but which they have treated so as to merit the applause even of those who have made Fossil Zoology the business of their lives, v. Mr. Lyell's Address to the Geological Society in 1837.

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* See No. 12 of the Madras Journal for a description and representation of this fossil. —Ed. M. J.

The discovery of Fossils in the Sewaliks is recent, and its history easily traced; but it is difficult to ascertain who first discovered them in any part of the Himalayas. The Gunduck has long been known to bring down Fossil Ammonites, which are called *Saligrammi*, and are much esteemed by the Hindoos. The Fossils represented in the upper part of plate 3,* from the elevated land on the N.E. of the line of Snowy Peaks, have also been long known in India by the name of *Bijli ke har*, or *Lightning Bones*, being employed by the natives in medicine. Capt. Webb and Mr. Traill were probably the first to bring them to the notice of the public; the specimens figured are from the collection of the Geological Society, having been presented by Mr. Colebrooke, to whom they had been sent by those gentlemen. The fossil shells figured in the lower part of the same plate,† are due to the researches of the late Dr. Gerard, who, I believe, first discovered them in the elevated valley of the Spiti, N.W. of Kunawur, though the date when, is not well ascertained; several, however, were figured at Calcutta in the Gleanings of Science for September 1831, where Capt. Herbert's paper on the Geology and Fossils of the Himalayas is published.

These fossils are all from the northern face, beyond what may be considered the true Himalayas. Nothing had then been discovered on the southern aspect of the mountains, with the exception of some at Caribari, in the small state of Cooch Behar, on the banks of the Brahmaputra, which were noticed by Mr. Colebrooke, in his account of the

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* Illustrations. † Do,

Geology of the N. E. border of Bengal. But this point was so remote from the parts of the Himalayas usually visited, that it was long before it was discovered that they formed a true clue to the nature of the formations at the base of these mountains. The Author also, in December 1831, discovered some fossil fragments on the banks of the Jumna, which, though at first doubted, were afterwards proved to be such by chemical analysis, v. J. A. S., p. 457. Abundance of fossils have since been discovered there by the engineers employed in improving the navigation of the Jumna: v. papers by Capt. E. Smith, and by Mr. Dean, J. A. S. ii., p. 622, iii., p. 302, iv., p. 261.

Dr. Govan, in September 1831, discovered some Himalayan limestone which bore the impression either of a reptile or of one of the crustacea, which has not yet been described, but with this exception, nothing had been found on the southern face of the Himalayas, or from the plains to the Snowy Peaks, and yet diligent search had been made for fossils in the Sewaliks themselves, but chiefly from the Kheree Pass to Hurdwar, by Capt. Herbert, and by Mons. Jacquemont at Nahun and in the Kheree Pass, as professed geologists; by Capt. Cautley and the author in their occasional visits to the latter and to Hurdwar. Capt. De Bude of the Engineers, when cutting down the rock at Hurdwar, and the shingly summit of the Kheree Pass, had been requested to look out for any appearance of fossil remains; and one of the officers of the Engineers, who has since distinguished himself in such discoveries, almost threw himself upon what he conceived to be a deposit of fossils, when the police officer who is stationed near the head of the Kheree Pass came up and informed the party that a camel had died there in the previous year. Lignite had been discovered here, and described by Capts. Herbert and Cautley. To this the author projected a visit, before leaving that part of India, with Dr. Falconer; but, as time was wanting, the latter went alone, and "returned loaded, not only with lignite, but with noble fossils of the monsters of the deep; bones of crocodilidæ, fragments of the shell of large turtles, and a fragment of a bivalve shell as large as an oyster."—Journ. As. Soc., i. p. 97,—as announced by the author in some notes read to the Asiatic Society in February 1832, when he was led to inquire whether those fossils did not probably belong to the same formation as those discovered by Dr. Wallich and Mr. Crawford on the Irawady. No further progress seems to have been made until April 1834, when Dr. Falconer picked up the shell of a fossil tortoise in the Timly Pass; Capt. Cautley immediately proceeded to the Kaloowala Pass, where he had discovered the lignite in 1827, when Dr. F. recognized a bone, and in the course of the digging, they found teeth of crocodiles; shells of tortoises; teeth, apparently of squalus; and bones and teeth of a pachydermatous animal, apparently Anthracotherium. The lignite lies between two beds of marl, or clay conglomerate; and in the upper of them the remains were found. Lieut. Durand, in September 1834, met with this marl, or clay conglomerate, on the north face of Nahun, with tortoise, Saurian, mammal, and fish remains.

But this discovery was eclipsed by that of the more extensive and important deposit of remains of fossil mammalia on the same range of hills to the westward of the Jumna, to which the duties of the Canal officers often led them. Attention was directed to this by Lieut. Baker having had given him, by the Nahun rajah, the fossil tooth of an elephant (Elephas primigenius) which had been picked up at Sumrotee, near the Pinjore valley. Lieut. B. proceeded to the Ambwalla Pass, on the western side of the Jumna, and found a large bone of some huge animal; Capt. Cautley, with his characteristic zeal, immediately joined Lieuts. Baker and Durand; when they carefully examined the ravine and slip, and brought away from the *upper strata of sandstone* seven fragments of bone, some of very large elephants, and the tibia, apparently, of a camel. A thin bed of blue clay, or blue marl, underlying the sandstone, and dipping at an angle of 20° to 30°, was found full of fresh water shells, as of Planorbis and of Paludina, v. Journ. As. Soc., iii. p. 393.* Specimens were also procured from other parts of the range, proving that from the Jumna to the Pinjore valley these mountains abound in fossils; and, in March 1837, Dr. Falconer announced the discovery of a few of the same fossils near Hurdwar, and in large quantities to the eastward of the Ganges in the low hills which skirt the province of Kemaon. Since then, the progress of discovery has been rapid, and is fully recorded in the works quoted. A more particular account of the localities, with sections of the mountains, is given by Capt. Cautley, in his paper read to the Geological Society (9th March 1836), and published in the Transactions, 2d Series, vol. v., p. 267, to which I gladly refer, and have only to give a brief enumeration of the genera and some of the species which have been discovered in the Sewalik hills. Capt. C. states particularly, that to the westward of the Jumna these hills are less abrupt; gravel beds are less frequent and abundant, and they are composed of varieties of clay-slate, and quartz, which can be traced to the neighbouring and nearest mountains. He distinguishes the lower marl strata from the upper sandstone beds.

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* Though the Author refers to the Journal of the Asiatic Society, &c. as showing the publication of the information, yet he quotes chiefly from letters addressed to him by Capt. Cautley, and which are those referred to by Mr. Lyell in his address in presenting the Wollaston medal, in 1837, to the Author, to be forwarded to Capt. Cautley and Dr. Falconer.

List of Fossils found in the Sewalik Range, *by* Messrs. Falconer, Cautley, Colvin, Baker, *and* Durand.

QUADRUMANA.

Three species of Quadrumana, v. Messrs. Baker and Durand, Jour. Asiatic Soc. Calcutta, Nov. 1836, Tab. 6, fig. 2; Messrs. Falconer and Cautley, J. A. S., May 1837. One allied to Semnopithecus.

PACHYDERMATA.

Elephas primigenius.
Mastodon elephantoides { M. *latidens*, Clift. — *Elephantoides*, Clift.
——— angustidens.
Hippopotamus sivalensis, F. & C., v. Tab. 6. fig. a. b.
——— dissimilis, F. & C.
Anoplotherium posterogenium, F. & C.
Rhinoceros angustistrictus, F. & C.
Rhinoceros sivalensis, F. &. C., v. Tab. 6, fig. 4, a. b.
Anthracotherium silistrense, v. Tab. 3, fig. 12—15.
Chærotherium, F. & C., sivalense, F. & C.
Sus, (sp. undetermined).

RUMINANTIA.

Sivatherium, F. & C.
——— giganteum, F. & C., v. tab. 6, fig. 1, a., b., c., d.
Camelus (sp. undetermined: two undoubted).
Cervus, (sp. undetermined: numerous).
Antilope, (sp. undetermined: numerous).
Bos, (sp. undetermined: 1 new section in the genus), v. tab. 6, fig. 5, a. b., and fig. 6, a. b.

SOLIPEDA.

Equus Sivalensis, F. & C., v. Tab. 6, fig. a., b., c.

CARNIVORA.

Felis, (number, and character of species, undetermined).
Cats.

Canis, (species undetermined).
Bears.
Hyæna, (species undetermined).
Amyxodon, F. & C.
———— sivalensis, F. & C.

Indications of other Genera.

RODENTIA.

Hystrix, one, (sp. undetermined).
Mus, (species undetermined).
Castor.
Lutra.

REPTILIA.

Ghurial, (Gavial of Naturalists), or Leptorhynchus gangeticus.

Crocodile, (Muggur of Natives), or Crocodilus biporcatus, v. tab. 3, fig. 7 to 9. The head of a very large Crocodile.

Emys, (several species undetermined).
Trionyx, (several species undetermined).
Megalochelys, F. & C.
———— sivalensis, F. & C.

PISCES.

Heads, vertebræ, and scales, &c. of unknown genera and species.

Teeth of Squalus, v. tab. 3, fig. 4 & 5. Tongue of Raya? v. tab. 3, fig. 6, being the only appearance of marine remains.

TESTACEA.

Univalves and Bivalves, chiefly undetermined, but apparently—Unio, Cyclas, Cyrene, Paludina, Planorbis, Helix.

For detailed descriptions of these Fossils by the above gentlemen, see Asiatic Researches, Calcutta, 1836, Vol. xix., Part I., and Journal of the Asiatic Society of Bengal, No. 35, Vol. iii., p. 527; No. 45, 46, 48, Vol. iv., p. 495, 565, 706; No. 49, 53, 55, 57, 58, 59, 60, Vol. v., p. 38, 291, 294, 486, 579, 661, 739, 768, as quoted by the Editor of the Transactions of the Geological Society, Second Series, Vol. v., p. 278.

The Geological system of the Himalayas is extremely simple in the line of the sections, which are about fifty miles apart, and have been constructed from the Author's specimens and observations, commencing from the plains in both, extending to Kedarkanta in the one, and to near Shalma in the other. The formations may be treated of under the heads, 1st, of the Stratified, and, 2d, of the Unstratified rocks. The Stratified rocks consist of Clay-slate, with Limestone imbedded in, or alternating with it, and surmounted by a Quartz conglomerate, often called in India Greywacke or Grauwacke. Clay-slate continues for some time, and this is succeeded by Micaceous and other Schists and Gneiss. The Unstratified rocks consist of Trap-rocks and of Granite.

Stratified Rocks.—The Himalayas, between the Ganges and Sutlej rivers, like the Sewaliks, present towards the plains abruptly steep fronts, and a comparatively gradual slope in the opposite direction, from the strata dipping towards the north-east. As this is frequently repeated, we have a succession of steep ascents and sloping sides, with a deep valley intervening between two successive ridges, in which usually runs a small river, flowing either towards the Ganges or into the Jumna, or their feeders, or into those of the Sutlej. The drainage of these great rivers is every where separated by transverse ridges, which connect the parallel ridges, having the points of junction often projected into peaks, (*Illustrations*, Int. p. xvii). By proceeding along these ridges, we may penetrate far into the interior, without having occasion to descend into the valleys; but the mountain paths usually take the direct course, and we have thus a succession of ridges and of valleys to cross, and to experience great vicissitudes of climate, as well as a repetition of the geological structure and of the animal and vegetable forms which are dependant on this and on the climate. The plain-ward face being thus abrupt towards the south-west, has the solar rays falling on it more perpendicularly, and therefore experiences greater heat and dryness. The strata dipping towards the north-east, also produce, from their disintegration, a greater accumulation of earth on that side, while the springs following the natural slopes are more frequent on the north-eastern than on the south-western face of these mountains, and therefore the vegetation of the two sides varies much more than would be anticipated by any one who had not observed the difference (v. p. 16).

Clay-Slate.—In ascending the Himalayas, between the Ganges and Jumna, Clay-slate is invariably met with, of great variety of colour as well as of texture, and in many places most remarkably contorted, as at Rikikes, &c. below Surkunda Debee. In the ascent to Mussooree it is soft, variously coloured, and crumbling into small quadrangular pieces. At Mutrogh, below Budraj, near the spring which supplies water to the village, it may be seen of a fine texture, blue colour, nearly perpendicular, and easily splitting into large slabs, is used as roofing slate. It may be seen of a still finer quality, and in still larger slabs on the ascent to Choor. In many places, nodules of quartz are seen imbedded in clay-slate, and in some places this is found passing into micaceous schist. Copper is found in it, in the neighbourhood of Khalsee.

LIMESTONE.—In the ascent to Mussooree, alternating with the clay-slate, we find Limestone, usually compact and hard, but often honey-combed and cavernous, bluish in colour, passing to grey, whitish and chalk-like in some places, and becoming in others even black. It occurs first at Jureepanee, and then at the top of the range; it is also met with at Sahunsudhara, alternating with clay-slate and dipping east. It is found also in the Suen range, in the Kaphnul valley, as well as in that of the Riknal, and very conspicuously, and of enormous thickness, and over-topping the clay-slate, at Deobund. It is not, however, found constantly alternating with the clay-slate, even in the range which intervenes between the Jumna and Ganges rivers, as it is wanting near Budraj; also between Landour and Surkunda, though very abundant in the neighbourhood of Dhunoultee, one of the places which the Author recommended as an excellent site for a Sanatarium. The Limestone, though in such enormous, apparently amorphous masses, is rather partially diffused, when compared with the Clay-slate. Sometimes it is harder, and even non-effervescent, becoming also siliceous, and like chert; though the pure blue limestone, in connection with clay-slate, is the most common. In some situations it passes into beautiful calc spar, as at Dhunoultee; in others, into white saccharine Limestone, formed of large crystals, as in some places in mica slate and gneiss, as well near the granite of the Choor Mountain, and of Gungotri. Gypsum is found associated with the Limestone in some situations, as at Sahunsudhara, below Mussooree, and at Jureepanee, v. Herbert and Cautley (As. Res.) Heavy Spar, or Sulphate of Barytes, is found in the ascent to Landour, of which, as well as of the rocks, specimens were sent by the Author to the Asiatic Society in 1828. The sulphurous spring in the vicinity of Sahunsudhara, with the dripping rocks and numerous stalactites hanging down from the roof of the cavernous limestone, with the leaves, &c. encrusted with carbonate of lime, have often attracted the attention of, and been described by travellers.

QUARTZOSE CONGLOMERATE.—The Clay-slate formation is, in many of the peaks, surmounted by strata of a rock which Mr. De la Beche has denominated Quartz conglomerate. It varies much in appearance, being light grey coloured on Landour, coarse-grained and reddish on

Budraj, formed of rounded grains of quartz, and therefore usually called sandstone. This varies in appearance, but is usually found at the summits of the peaks, as on Budraj, Landour, and Surkunda, and even on Deobun, in thin isolated strata above the limestone. In other situations, it alternates with the clay-slate, and then, as described by Mr. Everest, " it becomes a distinct greywacke, consisting of a greyish green base, with numerous angular fragments of clay-slate imbedded. No such appearances could be observed in the slates which alternate with the Mussooree limestone; and this circumstance, coupled with that of super-position, seems to mark the quartz sandstone as the newest formation of the two."

Section No. 2.—The clay-slate met with in the interior is usually more uniform in appearance, especially in the line of the section, as on Tuen, where, however, it is much waved and crossed by veins of quartz, so on Acharanda and Jountgurh, and on to Bhok tibba. In the Khulan valley, clay-slate is alone found, and a precipitous slip shows the whole to be of uniform structure. At the head of the valley limestone is met with in masses; the dip is very generally to the N. E.

MICACEOUS AND OTHER SCHISTS.—Mica slate occurs in ascending the south-western face of the Bhok tibba, though clay-slate forms the mass of the mountain, and is immediately succeeded by the mica slate and gneiss series. The clay-slate sometimes passes insensibly into what has been called quartz rock and even grauwacke in India, and in others into mica slate, which is, in some instances, fine grained and dark coloured, so as hardly to be distinguished from clay-slate. Mr. Everest, in proceeding from Mussooree, along the Ganges to its sources, mentions that quartz sandstone soon became the predominant rock, and that the slate had nearly disappeared, being only found in the lowest ground, opposite Ballahaut. The line of junction of the two was seen only a few feet above the level of the river. Somewhat before this, the slate had partly assumed the appearance of talc-slate, having a faint glimmering lustre and a soapy feel. Beyond Ballahaut, he continued travelling near the line of junction of the two formations, the slate gradually passing into a perfect talc-slate, and the quartzy sandstone becoming rather more crystalline than before. Perhaps the name of quartz-rock might be more appropriate to it, though it still exhibited, in some places, traces of round grains agglutinated together. About Batwaree, the quartz sandstone ceases on the low ground, and the slate contains a mixture of quartz and felspar, forming a talcose gneiss, with hornblende occasionally intermixed. Traces of the quartzy sandstone yet remain upon the cliffs above, for some miles farther to the north, where a gradual passage of it may be observed into the talcose gneiss.—J. A. S., Dec. 1835, p. 692.

In the upper Section, No. 1, after the sandstones of the Nahun and Jytuk ranges, red marl, with veins of carbonate of lime, is seen in descending to the Julal river; and this is succeeded by the limestone and clay-slate series. About Booraree, mica slate, with crystals of hornblende, is met with, and iron pyrites in the valleys on both sides; mica slate succeeds, occasionally fine textured, and scarcely to be distinguished from clay-slate: in ascending to Phagonee, it becomes coarse-grained, and in some places abounds in garnets. Near Phagonee, a large vein of iron is seen, and some coarse-grained crystalline limestone; after which we pass to gneiss, before reaching the projecting masses of granite which form the summit of the Choor Mountain. Above Chowrass, a granite vein, running east and west, is seen crossing the mica slate. In descending, on the N. E. gneiss and mica slate, with garnets, are again seen. Near Chepal, iron ore occurs, and the slate becomes talcose in the bed of the rivulet, and a coarse plumbago slate is seen near the Soonth. The same formations are repeated in proceeding towards Changshill and Kedarkanta. In ascending to Bumpta, the slate becomes very quartzose, with layers of mica, occasionally assuming a granitic structure. On Urukta, mica slate, with garnets, is found, and often with nodules of quartz. In the descent by Deyra, the slate is met with containing grains of magnetic iron, in sufficient quantity to be profitably worked, and which has been named Hornblende Slate by Mr. De la Beche (Manual, 3d Ed., p. 435): it is associated with gneiss and mica slate.

GNEISS.—The system of slates is succeeded in the section by a more uniform formation of gneiss. The extent of which will vary according to our view of what is gneiss. Capt. Herbert calculated the gneiss to be of great breadth, forming a band of which the lowest point is 2,800, and the highest 25,709 feet high, thus including the lofty peaks and the snowy range; as he says: "The highest peaks are everywhere composed of gneiss, the strata of which may be clearly distinguished, when bare of snow, through a telescope. Granite has no where been found except in veins, and these veins are generally small, with one exception—Whangtoo on the Sutlej." In this Capt. H. was incorrect, according to the testimony both of Dr. Falconer and of the Rev. Mr. Everest (v. infra). "The gneiss is of very various character, as far as colour and grain are concerned, though always very regular, consisting of the usual ingredients, united in the usual proportions; garnets, schorl, kyanite, carbonate of lime, green quartz, and hyacinth, are the most ordinary imbedded minerals. A speck of native gold has been found in a specimen from one of the granite veins."—*Gleanings of Science,* v. 3, p. 268.

Gneiss is found in many of the Passes, associated with chlorite and hornblende schists, as well as quartz rock, sometimes passing into micaceous schist; it is often found in the vicinity of granite, but is soon succeeded by micaceous schist, and this sometimes becoming talcose. The strata in general dip to the N.E., but great irregularities exist, and many instances are seen of their dipping in an opposite direction, but only to a limited extent.

Unstratified Rocks.—Trap-rocks, though frequently met with in fragments, were not until lately, recognized as forming a remarkable feature in the structure of the Himalayas. They were noticed by Capt. Herbert, and compared by him to Greenstone, as the schist in the descent to Khalsee, which he calls a Protean green slate, passing into a rock like greenstone. He also observes, that a trap-like rock is found in the vicinity of Bheemtal, and mentions a "Toadstone, of which the original mass is doubtless to be detected." But a vein of greenstone was discovered by Dr. Falconer in the neighbourhood of Mussooree, and the presence of trap-rocks has since been detected in numerous situations. Previous to this, the elevatory force was supposed to depend upon granite, which is revealed at the surface in so many places in Kemaon, and was supposed to be concealed under the surface to the westward of the Ganges, and raised to a great elevation only at the Choor Mountain. Hot springs abound in the Himalayas, and evidences of recent volcanic action were observed by Mr. Vigne in Cashmere, and have been seen by Dr. Falconer.

The igneous rocks, Dr. F. says, which have been found in the outer tracts, are of the green trap series, and are very generally met with in dykes, intersecting and rising through the regular strata, which are in all directions fractured or comminuted, and the limestone broken up into masses. The Mussooree vein is composed in some places principally of compact white felspar and pyroxene, and in others chiefly of hornblende, and may be traced for half-a-mile in a direction nearly parallel to the range of the mountains. Trap is also met with in one of the ascents to Mussooree, in the bed of the Jumna, and in the neighbourhood of Khalsee, and therefore abundantly displayed even within a limited extent. Mr. Everest mentions having crossed three different masses of greenstone in his journey from Mussooree to Gungotri: first, on the ridge before descending into the valley of the Ganges, and two others in the clay-slate and talc-slate. He could not in either case trace their connection with the surrounding rocks, but infers that it probably crossed them nearly at a right angle, and if so, their range must approach to a parallel with that of the granite.

GRANITE.—From the foregoing extract from Capt. Herbert, the comparative absence of granite in the Himalayas might be inferred, though in the line of section a magnificent outburst is observed on the summit of the Choor Mountain, which is greyish coloured, coarse-grained, with veins of quartz, and is porphyritic towards Roundee. Enormous boulders of it may be seen in the valleys, both to the north and south. It was suspected to occur in other places, as boulders and hand specimens were well known and totally different in character from the Choor granite. Capt. H. was well acquainted with its existence in many places, as he says: " Granite displays itself on the southern face in several places, as at Champawut, Dhie, Almorah, Shaee Debee, Dooarahath, Pale dhore, Kunyoor, and Choor, situated, except the latter, in beds in a zone of minimum elevation, and a line passing through them all, has a direction to N. 60° W., the same as that of the strata and mountain range. West of the Ganges no such beds are found, but the granite occupies the summit of Choor; and this is the highest of the mountains of the southern slope of the Himalayas, excepting only those which form the snowy peaks and passes." In colouring these on the large map of the Himalayas they form a line beautifully parallel to the direction both of the Sandstone and the Himalaya range. On the higher belt and northern face, according to Capt. Herbert, and towards the central and highest parts, Granite veins are frequent, as at Whangtoo or Huttoo; and it is mentioned by himself, in his section of the Gonass Pass. But, notwithstanding this, he seems not to have recognized it at the sources of the Ganges, as Dr. Falconer writes me that " the section about the formation of Gungotri, instead of being of gneiss, is all, to the northward of Sookhee, purely granite, and most palpably so, a binary compound of felspar and quartz, with crystals of tourmaline. It is the grand granitic axis of the Himalaya, and one of the greatest and most magnificent outbursts of granite in the world." He went across the direction of it for many miles up the Bhaghiretty, beyond the temple at Gungotri, and saw no end of it. The granite escarpments shooting up into the highest peaks, and the huge cairns of granitic blocks, many of them as large as a house, he describes as inconceivably grand.

The Mines and Mineral productions of the Himalayas have been detailed by the late Capt. Herbert, Superintendent of the Mineralogical Survey of the Himalayas, in a Paper in the Asiatic Researches, Trans. of the Physical Class, 1829, Part I., p. 227, and may be enumerated as Sulphur, Sulphate of Iron, Alum, Bitumen, Graphite, Gypsum, Limestone, Dolomite, Potstone, or indurated Talc. To these Calc Spar and Heavy Spar may be added.

Gold, in many of the streams, and specks of it in the Granite, near Kedarnath.

Copper, Grey Copper, and Copper Pyrites, and Green Carbonate.

Iron.—Red Oxide, Red Hæmatite, Micaceous, Scaly, and Specular Iron Ore, Compact Red Iron Ore, Magnetic Iron Ore.

Lead in form of fine granular Galena. Of the value of the mines we may expect a fuller account from the investigations of Captain Drummond, accompanied by his Cornish miner.

Kunawur and the northern face of the Himalayas. The Geology of this tract is little known, but we may expect a detailed account from the results of Mons. Jacquemont's investigations. Capt. Herbert, Gl. iii., p. 269, has briefly indicated its characteristics.

The Gneiss zone being stratified, and dipping at no great inclination to the N. E., the consequences to be expected are, that in proceeding to the north-eastward, the same succession of strata would be found, but at greater elevations. And this is the fact: although the development of rocks to the north is not equal in extent to those on the south side. Micaceous schist, with its associates, gradually gives way to grauwacke slate or grauwacke, which rocks are found at considerable elevations. Limestone, with organic remains, is found in beds in these rocks, and at such an elevation that the tertiary strata may be expected to occur at very great heights, and even the superficial deposits which have been called *diluvium*.

From the physical features of the country, the existence of tertiary strata might be *expected*, but these have been proved to exist by the Fossils, including the skull and lower jaw of a hollow-horned Ruminant (Antilope), that referred to by Capt. Herbert, Gl. iii., p. 270, with the tooth of a Rhinoceros. Those of the Horse, and Ox are also mentioned as having been found. The locality of these is not known, but Capt. H. concludes that they are from the northern face of the ridge which separates the basin of the Ganges from that of the Sutlej, and not far from the town of Dumpa.

The Fossils described by Dr. Gerard, Gleanings iii., p. 92, as found by him in a loose stratum of black schist, elevated 13,000 to 15,000 feet upon the declivity of the Spiti. The Terebratulæ were particularly remarked on the Laitche Lang Chain, the third great ridge of the Himalayas, at an elevation of 17,000 feet, altogether distinct from the above formation. From the examination of the shells, the Rev. Mr. Everest concluded that there exist in the Himalayan range strata analogous to the early secondary and transition formations of Europe; Gl. iii., p. 30. Specimens of the shells having been sent to Mr. J. D. C. Sowerby, he coincides in this view, and considers some of them as identical with shells of the mountain Limestone, Inferior Oolite, and Lias of England. J. A. S. 1., p. 248. The species in my collection, obtained chiefly from Dr. Gerard, consist of Astarte, a genus of which it is extremely difficult to determine the species. *Arca* or *Cucullæa*, Avicula, Terebratula or Atrypa, with a species not figured; a genus not determinable in my specimens: Delthyris? ; Ammonites, two species. The markings of both indicate that they belong to that division of the genus which range, from the Lias to the Chalk, both inclusive. Belemnites two species.

A section having been given of a portion of the Central Range of India, that is, from Sheerghatty to Rogonautpore, some details might be given respecting their Geological structure, but as the Author has already exhausted his space, he can only refer to the valuable papers of Dr. Voysey and of Colonel Sykes, as well as to that of Dr. Malcolmson, for the Geology of Central India, and to the Geological observations made by the Rev. Mr. Everest, on a journey from Calcutta to Ghazipore. Gleanings, iii., p. 129. The rocky basis of the range is composed of Gneiss, passing occasionally into mica slate; and that this alternates with hornblende rock, which is most conspicuous at the several Ghauts; and that they have both an anticlinal dip from the Granite and Trap, which make their appearance at the Suspension Bridge, and in the Bulbul rivulet. The Granite is also seen in outliers, and on both flanks of the range. On the Gneiss, a gray micaceous sandstone is horizontally deposited, but much disturbed in some situations. With the shale, &c. impressions of fossil vegetables are found, as well as Coal.

The Chinnakooree Coal formation, resembles that of Ranigunj, on the Damooda, described by Mr. Jones and the Reverend Mr. Everest, and noticed by Mr. De la Beche in his Manual, p. 399, from the Author's notes, but which he is compelled to suppress. Gneiss was seen near Pachette, but the hill over which the Author passed was found to be composed of Red Sandstone and Conglomerate. The Coal is imbedded in shale, with loose-grained gray Sandstone, both above and below. See the above Authors, as well as Mr. Mc'Clelland's able report of " A Committee for investigating the Coal and Mineral Resources of India"* (Calcutta 1838), where the discovery of a raised beach of tertiary shells in the Kasya Hills is noticed, and a list is given of all the sites of Coal (and Lignite, as those in the Himalayas,) at present known to exist on the continent of India. They may briefly be enumerated as follows,—BURDWAN, Ranigunj, Chinnakooree, Adjai Seedpoorie, Pariharpoor, Darbadanaghat, Benares Road 149th mile stone, and other places; Hazareebagh, RAJMAHAL, Patsandeh Baghelpoor, Skrigully, Hurra, PALAMOO, two principal beds, Amarath. BIDJEGURH. NERBUDDA, Towar river, Hoshungabad, Jubulpoor, Sohagpore, Chanda, Warda nala. CUTTACK, Mahanadi. ASSAM Deuphapanee near Bramakoond, Namroop river, Suffry or Disung river, near Rungpore, Dhunsiree river, Jumoona river, Kossila river near Gowahate, Chilmari and Doorgapoor. SILHET, Laour and other sites, Kasya hills Chirrapunjie, Sarrarim, Manipur near capital, Gendah on Kuenduan river. ARRACAN Sandoway District, Kyook Phyoo Island. MOULMEIN, Anthracite at Bothoung. SOUTHERN INDIA, Travancore, fossil seeds carbonized. HIMALAYA, Kemaon lignite, Moradabad, lower range. INDUS, Cutch, Peshawur. To these may be added the indications of Coal discovered in boring to a depth of 400 at Calcutta and 300 feet at Goga in Gujerat.†

The Shales of Ranigunj and Chinnakooree contain abundant remains of Ranigunj Reed; *Vertebraria indica*, nob., and of another species, *V. radiata*, nob., *Trizygia speciosa* referred formerly to Sphenophyllum? De la Beche, Manual, p. 400, and mentioned by Mr. Jones as " impressions of flowers." This appears to belong to the natural family of *Marsileaceæ*, v. p. 431.‡ Of this new genus there is a second species found in Germany, and the Author has a third species lent him by Dr. Mantell, from the Anthracite of Mount Carbon, in Pennsylvania. *Pustularia Calderiana*, nob., *Pecopteris Lindleyana*, and *Glossopteris danæoides*, are the other plants obtained from the same locality. *Glossopteris angustifolia*, and *G. Browniana*, are other species mentioned by M. Adolphe Brongniart. The presence of the latter is remarkable, as it was originally found in the carboniferous series of Eastern Australia by Dr. Robert Brown, v. De la Beche, Manual, p. 401.

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* Madras Journal, No. 20, p. 153.

† For an account of what has since been done in the search for this mineral, see a subsequent portion of this number.—ED. MADRAS JOURNAL.

‡ Illustrations.

It would have been interesting to have concluded this cursory view of the Geology of parts of India with a notice of the various mineral resources of that country, which though little developed are very abundant, and some of which have long been known to, and formed articles of commerce to both the ancient and modern civilized nations of the earth, as the Author has endeavoured to prove, from p. 40 to 47, and p. 95 to p. 104, in his "Essay on the Antiquity of Hindoo Medicine, London, 1838."

XII.—*The Meteorology of the Plains and Mountains of N. W. India.*

(From ROYLE'S *Illustrations of the Botany, &c. of the Himalayan Mountains, Supplementary Part).*

THOUGH the Meteorology of a country is frequently omitted in Works treating of Natural History, there is no subject which is more interesting or more closely connected with its several branches, especially when it is desired to point out the connection between climate and the vegetable and animal forms which it supports. This is still more important, indeed essentially necessary, when we desire to make any Practical application to the Arts of Culture of the results of our investigations into the Natural History of a country.

India being so extended in territory and varied in surface, with lengthened coasts, washed by a tropical ocean, and the summits of its mountains, covered by eternal snows, necessarily presents every variety of climate. As it is intended in the present Work to notice the vegetation of its heated plains and valleys, and to compare this with that found on the slope of its mountains, it is desirable, therefore, for the sake of comparison, to notice the more striking characteristics of the climate of different parts of India. This can only be done very briefly; but the Author hopes to be able to return to the subject, and give the details of his observations made at Saharunpore, from the year 1826 to 1830, with the Barometer, and both the Dry and Wet Bulb Thermometer, with observations on Radiation, Temperature of Wells, Quantity of Rain, together with Horary Observations, with all the instruments, from 1 A. M. to midnight, or for one day (the 15th) in each month for one year; occasionally also at different elevations, and at the different seasons of the year, in the Himalayan Mountains.

The instruments were compared with those of Captain Herbert and of Mons. Jacquemont, when these gentlemen passed through Saharunpore, and subsequently with those of my friend Mr. James Prinsep, on my arrival in Calcutta, and the differences between all were very slight.

As much of the vegetation of India is of a tropical nature, and as this is found extending into higher latitudes, or to considerable elevations, when local circumstances favour the production of a similar climate, we may therefore notice the characteristics of tropical climate, which consist in great uniformity of temperature, as well as of moisture, throughout the year. Various attempts have been made to ascertain by calculation the mean temperature of the Equator, assisted by the few observations which we possessed, of places in its vicinity. The illustrious Humboldt was induced to adopt 81° 5′ as the mean temperature of the Equator. Mr. Atkinson, on the contrary, inferred, that it was at least 84° 53′; but when it is considered that five-sixths of this line passes over the Ocean, the mean temperature of which between the limits of 3° N. and 3° S. varies, in general, between 80° 24′ and 82° 4′, and as the air which rests upon these waters is from 1° 8′ to 2° 7′ cooler, it is probable that 81° 5′ is not too low for the mean temperature of the Equator. Sir David Brewster, indeed, from observations since made in Ceylon, Penang, and at Singapore, is inclined to think that this may be too high.

The seasons in equatorial regions are well known to be characterized by great equability of temperature, and, in fact, they are not distinguished, as in high latitudes, into hot and cold, but into wet and dry seasons, and are greatly regulated by the periodical winds. In Java and Sumatra the thermometer seldom rises above 85° or 90° on the coast, falling as low as 70° at sunrise. The heaviest rains take place in December and January, the driest weather occurs in July and August, while the intermediate months afford variable weather. Singapore, from its insular nature, and being 1° 15′ North of the Equator, and near the S. extremity of the Malayan Peninsula, is well suited to give an idea of an Equatorial climate; there we have, fortunately, thermometric observations carried on for six years by Capt. C. E. Davis, three times a-day: at 6 A. M., 6 P. M., and at Noon (v. Journ. As. Soc. 2, p. 428), though the mean temperature deduced from them may probably be a little too high; but in the whole time the Thermometer never rose above 89°, or sunk below 71°, and the mean temperature deduced from the means of the extremes is 80° 01′ in all the years.

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Maximum....	84·5	85	87	87	89	88	88	88	88	88	86	86
Minimum....	70·5	73	72	74	75	74	74	75	75	75	74	74
	77·5	79·5	80	80·5	82	81	81.5	81·5	81·5	81·5	80	80=80·4

This degree of equability is found near the Equator only, but an approach is made to it during the rainy season of the year, both in higher latitudes and at considerable elevations, within the influence of the tropical rains, though the general characteristics of these situations is that of variableness of climate, or of a great range of the thermometer, both daily and annual. The result is the production, not only of great cold, but also of great heat, so that the thermometer is found to rise much higher at, and a little beyond the tropics, than in the neighbourhood of the Equator. This is accounted for, in some measure, by what has been observed by astronomers, that the sun, in his progress from the Equator towards the Tropic, advances in the first month 12°, and in the second 8°, so that at the end of the second month he is 20° from the Equator, and takes a month to advance the remaining 3½°, and an equal time to return, so that during the whole of this period the solar rays must fall nearly perpendicularly at noon on all places between 20° and 23½° of latitude, while a place situated under the Equator has the sun only during six days, as near the zenith, as the above places near the tropics have it for near two months; and, therefore, we may expect a greater degree of heat, which is moreover increased by the greater length of the days. The larger proportion of land near and beyond the tropic of Cancer, as well as the sandy barren nature of the soil, perhaps originally a consequence of, but now acting as a cause, in increasing the heat, together with the dryness of the air, all contribute, as causes, in increasing the absorption of, and the subsequent radiation of the heat imparted by, the nearly perpendicular solar rays. Thus Ritchie and Lyon state, that during whole months the thermometer stood at 117°, and at 128° in the Oasis of Mourzouk; Dr. Coulter mentions having observed it at 140° on the banks of the Rio Colorado, 32° 30′ N. lat., and we have it often stated as being 120°. Mr. Everest gives 111° as the highest at Ghazeepore; Mr. Prinsep as its being 114° at Benares. I have observed it at 107° at Saharunpore. The free radiation of the same open plains in the clear still nights of the winter months, causes a degree of cold which one is surprised to hear of as occurring in situations where the summer heat is so intense; hence the coldness experienced in some of the deserts of Africa, also by Lieut. Burnes, as well as in the plains of India.

The climate of many places in low latitudes has been ascertained, but of these we can only state the mean temperatures: as of places in Ceylon, from lat. 6° to 8½°; of Point de Galle, 81° 10′; of Colombo, 80° 75′; and of Trincomalee, 80° 56′; while the temperature of Madras, in lat. 13° 5′, has been ascertained, by numerous observations, to be 80° 42′. Pondicherry, on the dry and hot part of the Coromandel Coast, and in N. lat. 11° 55′, has the highest observed mean temperature, this having been found to be 85° 28′. Seringapatam, in lat. 12° 45′ N. long. 76° 51′ E., and elevated about 2,412 feet above the level of the sea, has a mean temperature of 77° 06′; the mean at sunrise is 63° 17′; at 3 P. M., 90° 95′; of the day, 84°; of the night, 70° 11′; the highest temperature observed was 115°, and the lowest 48°. At Bangalore, the mean temperature is about 74° 39′.

My friend Mr. James Prinsep, whose lamented illness all friends of science and of literature equally deplore, published, in the year 1832, the results of my observations, and as he has united them with others, I give his tables for the sake of comparison.

" The whole presents a convenient epitome of meteorological phenomena between 12° and 30° of north latitude. Of the climate of Madras, the minutest details are recorded in the voluminous and careful reports of the late astronomer, Mr. Goldingham, whose results merely required to be reduced to the freezing point. The Ava tables are abstracted from Major Burney's Registers, published in the ' Gleanings;' the Benares tables are taken from the Oriental Magazine, 1820; for the Saharunpore results we are indebted to Dr. Royle, who allowed us to look through his copious registers for the purpose. As the several barometers were never absolutely compared together, entire dependence cannot be placed upon the mean altitudes given; but with regard to Calcutta, Benares, and Saharunpore, as some opportunities occurred of comparison through the instruments of different travellers, the relative altitude of these places can be estimated tolerably well: thus, Saharunpore will be found to be almost exactly one thousand feet above the sea, as was before estimated by Captain Hodgson. Benares, in like manner, may be safely stated, in even numbers, to be three hundred feet above the sea.

Monthly Deviations *of the* Barometer *and* Thermometer *from their annual mean height at Calcutta; and at several other places, introduced for the sake of comparison.*

Month.	Barometer at 32° Fahr.					Thermometer.				
	Madras, mean of 21 years from 1796 to 1821.	Ava, 1830.	Calcutta, for three years, 1829-30-31.	Benares, four years' observations, 1822 to 1826.	Saharunpore 1826-27.	Madras, mean of 21 years' observations, max. & min.	Ava, 1830, sunrise and 4 P. M.	Calcutta, 3 years' observations, max. & min.	Benares, 4 years' observations, max. & min.	Saharunpore 1826-27.
	Inch.	Inch.	Inch.	Inch.	Inch.	Deg.	Deg.	Deg.	Deg.	Deg.
January........	+·146	+·229	+·208	+·273	+·274	—6·5	—13·7	—11·6	—17·0	—21.8
February.......	+·131	+·115	+·172	+·175	+·219	—4·5	— 4·9	— 6·0	—11·5	—20.9
March.........	+·087	+·051	+·095	+·107	+·151	—1·8	— 2·8	+ 1·0	— 1·5	+ 0.1
April..........	—·006	—·028	—·030	—·043	+·061	+0·7	+ 7·8	+ 5·1	+ 9·5	+ 6.1
May...........	—·124	—·105	—·152	—·136	—·060	+5·2	+ 5·6	+ 7·5	+13·9	+11.6
June..........	—·117	—·156	—·248	—·289	—·217	+7·4	+ 7·1	+ 5·5	+13·1	+ 17.5
July...........	—·103	—·176	—·218	—·308	—·398	+3·9	+ 4·4	+ 4·6	+ 6·9	+12.8
August........	—·088	—·126	—·194	—·203	—·278	+3·0	+ 4·1	+ 3·6	+ 6·4	+10.0
September.....	—·057	—·098	—·115	—·098	—·158	+2·1	+ 4·3	+ 3·7	+ 5·8	+ 9.5
October.......	—·018	—·010	+·020	+·074	—·047	+0·1	+ 2·2	+ 2·5	+ 1·3	+ 0.8
November.....	+·005	+·102	+·161	+·181	+·209	—3·1	— 4·2	— 5·4	— 9·7	—10.8
December	+·124	+·201	+·258	+·279	+·245	—4·9	—10·1	—11·5	—17·6	—13.8
Ann. mean..	29·810	29·573	29·764	29·464	28·766	81.69	78·39	78.13	77·81	73·5
Range.......	·270	·405	·506	·587	.672	13·9	21·5	19·1	31·5	39·3

" It will be remarked, that the range of variation in the weight of the atmosphere increases with the latitude, even up to the foot of the Himalaya Mountains, and that it is accompanied by a corresponding increase in the range of the thermometer.

" We now come to the *diurnal oscillation* of the barometer, for which the same sources have furnished me with materials for framing a comparative table for five localities considerably distant from one another; we could have added Moorshedabad to the list, but that the thermometric series for that place was incomplete. At Saharunpore the horary observations were confined to a single day, the fifteenth of each month; at Madras to three similar days; at Benares, perhaps, the hour of the minimum was not always exactly observed; thus a little irregularity must be expected, but on the whole the results are wonderfully equable.

DIURNAL OSCILLATIONS *of the* BAROMETER *and* THERMOMETER *at Calcutta, with Comparative Observations at other places.*

MONTH.	BAROMETER AT 32°.					THERMOMETER.				
	Madras, max. & min. every tenth day for 1823.	Ava, 10 A. M. and 4 P. M.	Calcutta, 9 40 A. M. and 4 0 P. M.	Benares, 9 to 10½ A. M. and 4 to 6 P. M.	Saharunpore, max. and min. of one day in month.	Madras, 4 A. M. and 2 P. M.	Ava, sun-rise and 4 P. M.	Calcutta, sun-rise and 2 50 P. M.	Benares, daily extremes by register thermom.	Saharunpore, extremes of one day in each month.
	Inch.	Inch.	Inch.	Inch.	Inch.	Deg.	Deg.	Deg.	Deg.	Deg.
January..........	·072	·144	·123	·097	·103	11·0	9·4	20·7	17·8	24·5
February.........	·070	·126	·117	·103	·093	10·0	16·8	18·5	19·2	21·0
March............	·076	·107	·125	·121	·146	7·0	20·8	14·0	20·7	26·0
April............	·081	·110	·124	·125	·107	9·0	20·9	14·6	23·2	31·0
May..............	·081	·113	·115	·124	·160	9·0	20·4	13·7	21·9	38·0
June.............	·092	·136	·095	·113	·178	9·0	9·0	7·6	16·1	31·5
July.............	·097	·133	·090	·077	·103	7·0	6·6	6·1	9·0	15·3
August...........	·105	·109	·099	·088	·079	7·0	8·8	5·9	8·3	11·5
September........	·094	·145	·101	·103	·123	6·0	7·8	6·2	10·3	13·0
October..........	·068	·144	·110	·100	·120	8·0	5·0	8·4	18·1	31·5
November.........	·071	·127	·107	·107	·147	8·0	6·7	13·4	16·8	29·3
December.........	·071	·126	·114	·098	·124	9·0	8·5	17·1	16·3	17·5
Mean tide..	·081	·126	·110	·105	·120	8·5	10·6	12·2	16·6	24·2

" With due allowance for the difference of sensibility in the instruments, the above table shews that the average diurnal tide of the barometer between the Equator and 30° north latitude, exceeds one-tenth of an inch, and that it is progressively greater as the variation of temperature during the day is also greater. With regard to the *nocturnal tide* of the atmosphere, the Calcutta tables afford us no data, for want of an observation at 10 P. M., the hour of the supposed maximum at night; all that is indicated therein is, that the barometer is constantly *lower* at sun-set than at sun-rise. At the Madras Observatory, in 1823, a series of horary observations was made for three days in each month, which seems to establish the fact of a night-tide beyond a doubt to the extent of .04 inch; when, however, the corrections for the temperature of the mercury are applied, this amount is reduced to two-hundredths of an inch, which is one-fifth only of the *diurnal tide*.

" The same result is obtained from a month's horary observations, undertaken by Col. Balfour, at Calcutta, in the year 1784. At Saharunpore, also, the existence of a nocturnal tide is equivocal: the following table exhibits all that we can gather towards the elucidation of the point in India, expressing by minus signs the real tide, or fall of the barometer, from 10 P. M. to 5 A. M., and *vice versâ*." Mr. Prinsep concludes by saying, " There is still sufficient ambiguity respecting this second tide, therefore, to render further inquiry necessary, and it would be desirable to employ a barometer for the purpose, which should not require to have any correction applied for the temperature of the mercury; this might be easily effected, by enclosing the barometer tube in an outer tube of the same length, also filled with mercury, upon the surface of which the scale might float."

NOCTURNAL OSCILLATION *of the* BAROMETER *from* 10 P. M. *to* 5 A. M. *reduced to* 32° *Fahr.*

MONTH.	Madras, three days in each month.	Berhampore, from Dr. Russel's tables.	Saharunpore, Dr. Royle's observations.	Vera Cruz, in Mexico, by Fray Juan.
January......	—·004	+·034	—·043	+·018
February.....	—·029	+·026	—·009	+·009
March........	—·026	+·069	—·008	—·002
April.........	—·027	+·008	—·007	+·008
May...........	—·014	+·020	—·020	+·005
June..........	—·026	+·012	+·039	+·003
July...........	—·009	·000	—·005	—·002
August.......	—·028	+·014	—·016	—·007
September...	—·024	+·011	+·011	—·012
October.....	—·033	+·009	—·004	—·021
November...	—·010	+·009	+·024	+·001
December...	—·019	+·027	+·015	—·023
Means...	—·021	+·020	—·001	—·002

Saharunpore, as we have seen, is situated nearly at the head of the great Gangetic valley, in N. lat. 29° 57′, long. 77° 32′ E., one thousand miles north-west of Calcutta, in the Doab, or space included between the Ganges and Jumna rivers, about twenty miles from the former, and nine from the latter, and about thirty miles from the Sewalik or Sub-Himalayan range of Mountains. It is celebrated as the station whence the Trigonometrical Survey of the Himalayas was commenced by Capts. Hodgson and Herbert (Illustrations, Introduction, p. xii.). It was then calculated by Captain, now Colonel Hodgson, to be elevated 1,013 feet above Calcutta. Mr. James Prinsep, from my observations, compared with his own, in Calcutta, calculated that my house, situated in the vicinity of the Botanic Garden, was as near as possible one thousand feet above the sea (Journ. As. Soc., vol. i. p. 29). The characteristics of the climate are mentioned at p. 7, of the Illustrations in connection with the vegetation, which is described as being tropical at one season, and partially European at another, and as having, in consequence, an eqnally varied cultivation. To display this connection of climate with vegetation, it is desirable to give the temperature, so as to show the rise and fall of the thermometer; I have therefore thought it advisable to commence with the month of March, when increase of temperature takes place so rapidly. The thermometer was placed on the northern side of the house, but too near, for the extremes to be accurately observed, as, though the heat was probably greater, yet the cold was probably less, from the more confined radiation, as the minimum outside of a tent and not far from the house, was 27°, when the other was 38° 5′.

	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
Maxima......	89	96	105·5	105	95·5	92	91·5	90·5	84	69	64·5	81·5
Minima.......	47	62	67·5	73	76	78·5	64·5	57·5	45·5	44	38·5	45
Means........	68	79	86·5	89	86·75	85·25	78	74	64.75	56.5	52·5	63·25

Mean temp. ... 73·58

In connection with the thermometric observations at Saharunpore in the open plains of Upper India, it is interesting to give that of the Deyra Valley, in the same latitude, and about forty-five miles to the east. The observations were made by my late friend, the Hon. F. Shore, while Assistant Commissioner in the Deyra Doon.

	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
Maxima......	86	93	98	101	94	90	91	86	70	71	68	73
Minima......	48	53	64	71	72	72	66	61	44	42	37.57	45
Diff..........	38	40	34	30	22	18	25	25	26	29	30·25	28
Mean.........	67	73	81	86	83	81	78.5	73·5	57	56·5	52·8	59·5=70·65

From the greater number of cloudy days, as well as from the greater moistness of the climate, it is found difficult to ripen some fruits which succeed in the plains, though others, as Bengal Plantain, Guavas, and several varieties of Limes, arrive at greater perfection. The greater degree of moisture must be ascribed to the surrounding mountains, and to the quantity of vegetation with which the uncleared parts of the valley are covered. Like other valleys, it is also more close, as the winds cannot blow so freely as in the open plains. The evenings and nights are, however, pleasant, as a cool breeze generally descends from the mountains, and at some seasons of the year the climate is delightful.

In the ascent of the Himalayas, in the course of the Geological section, Jurreepanee is a mid-way station, where I have occasionally taken observations, and of which the temperature feels cool to those who are ascending, but warm to those descending from, the mountains:

	Ther.	Moist Bulb.	Barom.	Merc.	Spring of water.
April 4, eight A. M..........	64	49.5	24.84	71°	63·5
Oct. 2, half past seven A.M.	62·5				
July 22, eight A M..........	68				65·5
„ four P.M	79				

Mussooree and Landour are on the elevated range which rises immediately above the Deyra Doon, and where a Sana'arium for the recovery of the health of European soldiers has been established, as well as houses built by officers, and where I established a small nursery-garden, which was abolished by Lord William Bentinck, but re-established by Lord Auckland. The range enjoys a delightful climate, presenting as great a degree of equability of temperature from summer to winter, and from day to night, as is desirable. In summer the temperature is low, and all accumulation of heat is prevented by the coolness of the breeze which ascends from the valleys. The transition to the rains, which commence about the 15th of June, makes but little difference in the temperature, and the climate is remarkably equable; and though moist and usually cloudy, it is not otherwise disagreeable or unhealthy. In the month of October, or at the conclusion of the rainy season, and throughout November, the sky is so clear and serene, the air so mild and still, that the climate is perfectly delightful. The approach of the cold is so gradual, and its degree so moderate, as to be well calculated to brace the system, when improved by a previous residence in the hills. The coldest months are December, January, and February; in the last the greatest cold, and sometimes snow-storms, occur; after this, the rise in temperature is very rapid. Though 5,500 and 6,000 feet more elevated, the minimum, however, is very little lower than at Saharunpore.

The Author has already said, " that the cold of winter in these mountains, at least on the Mussooree Range, is not in proportion to the coolness of summer. It may be said, that with a winter temperature of their own latitudes,—that is, of the plains at their base,—they have the summer temperature of European countries; so that, without exaggeration, it might be said :—

Gurmush nu gurm ust,—	Its warmth is not heat,—
Surdush nu surd.	Its coolness is not cold."

The mildness of the night, compared with the coolness of the day, appears to be owing to the descent of strata of the atmosphere, which the heat of the day had caused to ascend. These, in descending to a lower station, become more condensed, and thus having their capacity for heat diminished, give out a portion of their latent caloric, which necessarily prevents the sinking of the temperature to the degree it otherwise would, in consequence of the cooling effect of radiation from the surface of the soil. Favoured as this process is by the stillness and clearness of the night, its effects would be more perceptible, did not the breadth of the ridge bear but a small proportion to the mass of the air by which it is surrounded. This equability of temperature is observed, not only from day to night, but also from hour to hour, and from summer to winter.

One great anomaly presents itself in consequence of the still calmness of the mornings; for though the nights are pleasant and the mornings cool, yet, from the rapid rise of the sun, and the great power of the solar rays, the heat becomes considerable, and even insupportable in the open air, until a gentle breeze rises, and ascending up the valley, continues through the day, apparently following the course of the sun. The maximum of temperature frequently occurs at ten, or, at all events, the increase after that is so slight as not to be perceptible to the senses. In the plains we know the temperature of the air goes on increasing until 2 or 3 P. M. As the latitude is nearly the same as that of Saharunpore, the power of the solar rays and the quantity of heat communicated in a given time must be nearly the same; but in the plains it is allowed to accumulate: in the hills, on the contrary, the breeze which sets in daily from the plains towards the hills, and which commences about 10 A. M. (the very time after which so little increase takes place in temperature), passes over the top of the range, and prevents the accumulation of any heat. This breeze, though caused by the heat of the sun rarefying the dense air, at the surface of the earth, might be expected to arrive at the mountain top in the hot and parched state in which it rose from the heated plains; but the air as it ascends becomes still less dense, and in proportion to this diminution of density is its capacity for heat increased; so that it absorbs all the caloric which, in the plains, was sensible to the feelings, or was observed by a thermometer, and thus, on arriving at the top of the range, it feels cool and refreshing.* At night, a similar, but more gentle breeze, sets in from the hills towards the plains, and the two may, with the strictest justice, be compared to the land and sea breezes of the Coast and of Equatorial islands.

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* These observations were first published by the Author in a Paper read before the Asiatic Society of Calcutta, and extracts published in the Journ. As. Soc., vol. i. p. 97.

As instances of the very gradual rise and fall of the thermometer from hour to hour, as well as of the little diminution of heat during the night, the following observations are subjoined, which were all carefully made in the open air, and on clear sunny days, but in the shade:—

Time.	5.	6.	7.	8.	9.	10.	11.	12.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
April 19	58	—	—	70·5	76·5	77	76	75	76	—	67*	69	—	—	—	—	—	—	—	60
,, 21	59	62	66·5	72	74·5	74·5	73·5	73·5	71·5	71·5	72	71·5	68	65	64	—	—	63·5	†	—
May. 6	53·5	58·5	63	68	75	75	75·5	76	75·5	72	66*	70	69	—	64	—	—	58	—	—
Sept. 29	57	59	60	61	—	69	—	69	—	—	—	66	—	—	64	—	—	60	‡	—

The transition to the rainy season is not accompanied with so great a diminution of temperature as might be expected. In the year 1829, the rains came on on the 15th of June. The mean temperature of the two previous days were 67° and 68°, while that of the twenty-four hours subsequent to the rains was 62°, and that of the whole day of the 16th was 63·5

A thermometer hung up in the sun, and freely exposed to its influence, as well as to that of the air, was usually from 5° to 10° higher; the maximum generally taking place about 12.

Atmospherical pressure is also very equable; but the observations have not all been made with a stationary instrument, nor all at the same place in the hills. At the top of the range, where the houses were first built, the barometer observed in September, October, December, and April, did not differ at these various times more than one-tenth of an inch, or from 23·60 to 23·50. Mr. S. Boulderson has published his observations in another part of the same range, called Caineville, from 15th May to 21st of November: he has 24·158 as the maximum mean of seventeen observations, from 1st to 21st Nov., at 10 A. M., while 23·815 is the minimum of twenty-two observations in June, at 4 P. M., giving a range of ·343 inches.

The daily periodical fluctuation was observed to be as regular in the hills as in the plains. The maximum height to which the barometer rose was always about ten o'clock, and the lowest to which it fell, about 4 P. M.

From the equability of temperature as well as of pressure, we might also expect considerable equability of evaporation; but if it were not for the increased capacity of air for moisture, as well as for caloric, in proportion to its rarefaction, the climate would be a very moist one, as, indeed, is the case in the rainy season. From my observations, however, it appears, that there is always a moderate degree of evaporation in the Mussooree climate; the greatest difference, or 20°, between the dry and moist Bulb Thermometer, occurred on the 6th May; on the same day, the difference at Saharunpore was 32° 5′. On the 5th April, in the morning, after rain, the difference was 7° 5′, while at Saharunpore, on the 7th, also after rain, the difference was only 3° 5′. Even when enveloped in a cloud on the Mussooree range, I have found 2° difference between the dry and moist thermometers, and on cloudy days the difference varied from 4° to 10°. Also at the conclusion of the rains, that is, on the 29th September, the mean of the differences on the Mussooree was observed to be 7° 7′, while at Saharunpore it was only 6° 7′.

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* Cloudy. † 57·55 next morning. ‡ 56 next morning, at day break.

The meteorological phenomena observed in the years 1827 and 1828, have been reduced to a tabular form, which will give a good general idea of the nature of the climate, as they nearly correspond with those observed in subsequent years; but the peculiarity of seasons, their greater dryness or moisture, later accession of the rainy seasons, or the total absence of a snow-storm, in some years, will, of course, here, as elsewhere, modify the temperature of particular months.

Results *of* Meteorological Observations *at* Mussooree.

Month.	Means of all the Observations.	Maximum during each Month.	Minimum during each Month.	Means of Maxima and Minima.	Increase and Decrease of each Month.
	°	°	°	°	°
January........	42·45	51·5	34.5	43	—2·55
February.......	45.42	63	27	45	+2·97
March..........	53·63	69	37	53	+8·21
April............	59·83	77	41	59	+6·2
May..............	66·01	78	41	59	+6·18
June..............	67·12	74	61	67·5	+1·11
July................	67·35	71	63	67·5	—0·23
August............	66·43	69	63	66	—0·92
September......	64·04	69·5	57	63·25	—2·39
October........	57·25	66·5	48	57·25	—6·79
November......	50	57	48	52·5	—7·25
December......	45	55	29	42	—5·
Mean Temperature of the Year.	57·04			56.5	Mean Temperature of the Year from the Monthly Maxima and Minima.

XIII.—*Report of the Coal Committee.*

In submitting a summary of what has been done since our last Report, we shall commence with the

Tenasserim Provinces.

Coal has been found in the Tenasserim provinces by Dr. Helfer in two situations above the falls of the Great Tenasserim, at a distance of eight and nine days' jonrney, respectively, from the town of that name, but the quality is inferior, and the situation quite beyond the reach of any mode of conveyance to the coast.

Although the quality is excellent in a third situation in which the mineral has been found by Dr. Helfer, yet its distance from the coast is such as to render it of very doubtful utility on the Bengal side of the peninsula, whatever benefit it may eventually prove on the Gulph of Siam, as it seems to be situated beyond the boundary range of hills. Fortunately a still more recent discovery by a native, places us in possession of what would seem to be a most excellent coal, close to the banks of the Great Tenasserim river, and within twenty-nine miles of the town of Tenasserim.

Two reports have been addressed to the Commissioner of the Tenasserim provinces on the last mentioned coal, one by Lieut. Hutchinson, dated 6th May 1839 ; and the other, of a somewhat later date, by Dr. Helfer. From Lieut. Hutchinson's report, we learn that the position of this coal is 12° 21′ 30″ N. lat., and about 99° 5′ E. long., or, by the course of the river, twenty nine miles from the town of Tenasserim, and sixty-five from Mergui, although its direct distance from the coast is only twenty-eight miles. The coal is said by Lieut. Hutchinson to form a thick bed, covered by three feet of "*clay slate,*" and from twenty to forty feet of *sand, which is so tenacious* as to require no propping where springs do not exist. In a subsequent correspondence on this subject, the coal is described as within ten feet of the surface, and from all we can learn, we have no doubt it might be worked like crop-coal, and clay ironstone, as described by Mr. Farey, i. e., merely by sinking pits down to the coal and raising it at once, and after undermining on all sides as much as can be done safely by the use of props, the latter may be withdrawn, and the roof allowed to fall in.

This coal burns with a bright flame, and answers admirably for steam purposes. Fifty pounds tried in the still furnace laboratory of the

Honorable Company's Dispensary, afforded four gallons of distilled water, and left a residue of four pounds weight of ashes, cinders, and small coal that fell through the bars of the furnace during combustion.

Its specific gravity is 1·27

Composition,

Water,	9
Volatile matter,	46
Carbon,	40
Ash,	5
	100

The distance of this coal in a direct line from the coast being only twenty-eight miles, Lieut. Hutchinson proposed to construct a road, which he supposed would reduce the expense of delivery on the coast considerably. Boats of large draught it is said, may ascend the Tenasserim river at all seasons to Tenasserim town, within twenty-nine miles of the coal, and during the rainy season to the coal itself, so that nothing could be more favourable than the position of this coal for all purposes of local improvement, as well as for steam navigation to the eastward. Forty tons of this coal cost 5½ annas per maund at Mergui, and 8 annas per maund in Calcutta. The Government have called upon Mr. Blundell, the Commissioner of the Tenasserim provinces, to provide 50,000 maunds; and have furnished a working party, consisting of persons accustomed to mining, for the purpose, and have intrusted the superintendence of the necessary operations to Lieut. Hutchinson.

We have been informed by Captain Lloyd, I. N., that about one degree lower down the coast, coal has been found of very good quality on the *Senhea* river, but the Committee have no information on this head, although some progress had been made in raising a quantity, when the work was discontinued in consequence probably of the more favourable position of the coal near Tenasserim. The Senhea coal is situated, Capt. Lloyd thinks, about 11° 22′ N. lat., and 99° 8′ E. long. about forty miles up the river, the navigation of which is doubtful. It is however the most southern point at which coal has been hitherto found on the Malay coast.

A detached fragment of an inferior coal called Anthracite by some, has been found near Maulmain, latitude 16° 30′ N. thus indicating the presence of coal formations between the Tenasserim coal fields, 12° N. latitude, and Arracan 19° N. latitude, and holding out strong inducements to further search being instituted in that quarter.

Arracan.

The more we know of coal, the more are we impressed with the fact, that it never presents false indications of its presence. There is hardly an instance either in India or elsewhere of its appearing at all, that it does not do so under circumstances to render it in the highest degree important to Society; and although at first the quality and extent of the beds in any new district may be for a time doubtful, yet experience teaches us, that where these indications do not improve in proportion to the intelligence and enterprise directed to their complete development, the mineral is not true coal, but a substance, the peculiarity of which is easily detected, as the brown coal of English geologists. The samples of coal we received from different parts of the Arracan coast, were such as to leave no question whatever as to the beds from which they were taken belonging to the true coal formation.

Coal has been found composing a part of Oogadong, a small island opposite to the harbour of Kyak Phyo, in two situations not very far from each other. The sample supplied was much impregnated with pyrites, it was however a caking coal, belonging to the true coal measures. It would be a desirable object to try how far the Oogadong coal might answer for the reduction of Rambree iron ore, which is very abundant. Red Hill being said to be composed entirely of an ore that was formerly worked to some extent by the Burmese, a small quantity of the ore and coal might be sent to Calcutta for trial, and if the result proved satisfactory, trials on a larger scale might be repeated on the spot, where experiments of the kind must always be cheaper and more satisfactory than when made at a distance. Coal has also been found on Paget, or Adam's Island, south of the great island of Rambree. It has also been found in small seams in one of the Bolonga Islands, as well as near the beach at Sandoway; but the necessary information is wanting to enable us to conclude any thing from these indications, beyond the fact of the existence of coal, to a great extent, in the Arracan provinces.

The most promising bed yet found, is one that was brought to the notice of the Commissioner, Captain Bogle, by Lieut. Lumsden, who states that it was found about two years ago by persons employed in coal-finding by Captain Williams. This coal occurs at a place called Hoong, near the head of a river, which descends from a range of hills on the southern extremity of the island, falling into the Sandoway channel. Mr. Lumsden states that large boats may approach to the very spot where the coal is found. On visiting the spot, Mr. Lumsden found "an irregular vein of coal, of about a foot in thickness, mixed with broken red sandstone, and on working below it, he came to a kind of *clay-slate* and eventually to water." Mr. Lumsden, however, states that he was obliged from fatigue to leave the work to a native, who in a few days brought to him 120 maunds of coal—a larger quantity than we should have supposed a native could procure in so short a time, under circumstances described by Mr. Lumsden. A sample of this coal, consisting of four or five maunds, was brought to Calcutta by Captain Bogle, and tried in the Laboratory of the Honorable Company's Dispensary, and found to burn with a clear bright flame and very little smoke. The following are the results of its analysis:—

Specific gravity, ...		1.28
Inflammable matter, ...	40	
Carbon, ...	54	
Ferruginous ash, ...	6	
	100	

It is a free burning coal, giving out a strong heat, and would no doubt be found suitable to steam purposes, as it is quite free from the sulphureous impregnation which rendered the former samples of Arracan coal objectionable.

The want of more satisfactory information than we yet possess regarding Arracan coal is much to be regretted, as there is no part of India in which good coal mines could be attended with more advantage, whether we regard the situation on the coast, or the peculiar circumstances of the province itself. This district is chiefly known to Europeans by the mortality that took place there during the late war. Few are aware that within twenty miles of the town of Arracan, there is a fine elevated chain of mountains, extending parallel to the coast, and affording no doubt as fine a climate as any part of the world, although the coast itself is low, and like many similar tracts in the north of Italy, and south of Europe, unhealthy. Let good coal be once discovered in abundance in this fertile province, and the deadly effect of climate to persons exposed in miserable boats, or damp huts surrounded by swamps, will disappear, and the indolent streams become the track of steamers, perhaps to the very foot of the hills, which might thus become available as places of residence.

Sylhet.

Although the attention of the Coal Committee has been constantly directed to this quarter, the only result accomplished since the last report, that can be said to be new, is the delivery of 10,000 maunds of

Cherra coal at Goalparah, in Assam, at the rate of eight annas per maund,* after the attempt to supply that station during the rainy season with coal at any price from Burdwan had failed.

Three beds of coal, situated near the foot of the hills, have been brought to notice, but we have no information on the subject to enable us to decide whether these are new discoveries, or merely the bed alluded to in our last reports, as having been brought to notice some twenty-five years ago by Messrs. Jones and Stark. Without going into that question, we shall merely state all we know of the three beds now alluded to.

The first and most promising, is that of Byrung Poonjie,† situated near a village of that name, within about two miles of water carriage, and the ground such as to allow of the construction of a hackery road.

We know nothing of the circumstances of the bed, further than is stated by Mr. Landers, a practical gentleman, who has been appointed for the superintendence of coal mines in Sylhet and Assam, and who observes—

" Byrung coal is of a soft quality, intermixed with stones three feet and a half high and varying in its thickness. The vein runs from east to west, and descends with the hill towards the south: to what extent this field may exist, it is impossible at present to say, the want of proper implements" (these have been since provided) " prevented me from ascertaining; a trial ought to be made by running galleries into the strata six or eight fathoms, at once to determine both height and quality, and also if it would admit of any outlay." This coal has been tried, and appears to be likely to answer very well for steam, while it has the additional advantage of yielding excellent coke.

Not far distant from the Byrung bed, there is another at a place called Chiela, or Chaila, which varies from one to three feet in thickness. This however is said to be an inferior coal.

Major Lister, to whom we are indebted for the first and almost the only information we have had regarding the two foregoing coals, states, that Mr. Inglis, of Cuttack, has found a coal bed above Chaila, at a village called Mustuk, above 1,500 or 2,000 feet above the plains, and within such distance of water carriage as to enable a porter to deliver five burdens daily from the pit into boats. Mr. Inglis is of opinion that this coal is quite as good as that of Cherra,* and Major Lister observes that it looks so, though the quality is different, being blacker, with an exceedingly high polish; it burns considerably longer than Cherra coal, and cakes less, but is heavier, and yields more ashes.

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* This having been done under the direction of the Marine Board, the Committee have documents on the subject.

† Communication has been received from Major Lister since the annexed remarks were written, stating that Mr. Landers has traced the Byrung Poonjie bed for two miles to the westward without finding more on an average than a foot of good coal; hence Major Lister and Mr. Landers conclude the Byrung bed is not workable.

The value of these, as well as similar indications alluded to in our last report, is still doubtful, and must remain so until the whole tract along the base of the Kasyah hills be submitted to a geological survey. For the present season, if the Government require coal from this quarter, we agree with Major Lister in thinking it will be necessary to confine our exertions exclusively to the Cherra bed. This, as is well known, is situated on the summit of a mountain, nearly 5,000 feet above the sea, and at such a distance from navigable rivers as to render it a day's work for each cooly to deliver a maund, or about 80 pounds, of coal from the pit into a boat.

The only way of lessening this inconvenience would be by improving the conveyance, by an improvement of the road. Above and below the steepest portion of the descent would admit of bullocks being used. Instead of porters for the steeper or middle portion of the journey, it has been proposed to construct a slide, as suggested by the late Colonel Watson. The improvement of the road between Cherra and the plains would be a work of some public utility, as it would be the means of facilitating ingress and egress to and from the mountain plateau, it would therefore be a very desirable object, independent of the coal. The value of a slide however, would depend entirely on our success in finding as good a coal below, as that which is above—an uncertainty which ought to be at once removed by a perfect geological survey, as already suggested.

Some difference of opinion prevails as to the best way of transmitting Sylhet coal to the great lines of inland navigation on the Ganges; some contending that it would be necessary in the first instance to send them a distance of 300 miles to Calcutta, and from thence back to Surda, and other depôts on the Ganges;—experience is the only way of settling questions of this nature, and measures are now in progress for the delivery of the largest possible quantity—10 or 15,000 maunds of Cherra Poonjie coal—in Calcutta, with the least possible delay, compatible with the fair trial of the experiment. The Kasyahs, on whom the burden of the experiment will literally fall, though a fine athletic race, are little accustomed to labour; Major Lister may therefore have some difficulty at first in reconciling a sufficient number of them to a continued effort, the object and importance of which, they can so little understand.

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* A cargo of it having recently arrived in Calcutta, it is now (4th May, 1840) under trial on a large scale, and promises to turn out very favourably.

It is necessary to take the quality of coal into account before any particular price per maund can be regarded as dear or cheap; it is quite incredible to what degree a slight difference in quality affects the value of coal, for steam vessels. It has been found by means of the only trial instituted between Cherra and other coals now in use, that 9 maunds are equal to 14 of Burdwan coal. Let us suppose (without laying too much stress on a single trial of a few maunds) the proportionate value of the two coals to be ascertained as above; 100 maunds of Cherra would not only as a fuel be equal to 155.5 of Burdwan, but we should also have to debit to the latter the value of 55.5 maunds stowage or tonnage, which might amount to more than the entire value of the coal consumed.

The Cherra Poonjie coal forms the cap of a hill, from which each cooly may help himself to his load almost without the aid of mining, so that the carriage, 4 annas per maund from the pit to the nearest navigable river, though high, may be said to include the expense of winning, or bringing coal to the surface. Could any of the following indications of coal lower down, towards the foot of the mountain, be found to yield good supplies, a portion, or nearly the whole of this large item of expense might be saved, viz. 1. Tipperah hills, in a small river which descends from a hill with a Musulman Doorga called Orpeen, on its summit; 2. Opposite to Jalalgur, in Lowr; 3. Patli river, and several streams descending from the Garrow mountains; 4. Near Susung; 5. On the top of one of the lower ranges at Lowr, and in the rivers of Lowr; 6. In the Dysung and its tributaries; 7. Between Pannalik and Bansekora; 8. Barachara; to which we have now added Byrung Poonjie, Chaila, and Mustuk, (vide para. 13, 14, and 15, of the present report).

The rate of boat-hire from the Sylhet district, along the verge of which the coal formation lies, to Surdah on the Ganges, one of the principal depôts for the supply of steamers, is stated by Mr. H. Inglis to be 21 rupees per 100 maunds. In regard to water conveyance, Sylhet has the advantage of any of the coal districts to the westward, while its proximity to the great rivers of Bengal gives it an advantage over the Assam coal districts; and thus while any mines that might be established in Sylhet would hardly be affected in value by similar establishments in any other part of India, there is hardly a district from Arracan to Palamow the value of whose mines would not seriously be affected by any subsequent discovery of coal in Sylhet. In like manner any collieries that might be established in

Assam, or other remote provinces, would be entirely superseded in the Bengal market by any new discoveries of good beds of coal that might be made in the Sylhet district. It is for this reason that we have laid peculiar stress on the importance of a thorough investigation of the coal measures along the base of the Kasyah and Garrow hills, since upon this, and the manner in which it is conducted, must depend in some measure the prudence of investing capital in more distant coal districts.

Surdah is within a few miles of Bogwangola, one of the greatest marts in Bengal for grains of every kind, goor, oil, ghee, and the chief articles of native consumption. Being situated in the centre of Bengal, near the junction of all the principal rivers, as the Bhaugarutty, the Ganges, and Bramputra, it is naturally the centre of internal commerce, and consequently the greatest mart for boats in Bengal. Surdah, or some situation in that neighbourhood, appears therefore to be the situation at which a General Depôt ought to be formed. We have consulted J. W. Grant, Esq. of the Civil Service, who had been long commercial resident at Maldah, and Major Carter, who has been for a large portion of his life in the Bengal Commissariat, and the experience of both these gentlemen goes to prove that at Bogwangola and Jellinghee, boats for the transmission of coal from Surdah to any part of Bengal or the Upper Provinces may be had to any amount of tonnage likely to be required.

The distance from Cherra Poonjie to Calcutta by water, is about the same as to Surdah; while the latter is one hundred and fifty miles nearer to Rajmehal, and other depôts to the eastward.

Major Carter states that the voyage from Calcutta to Cuttack in an empty boat should not take above 21 days, and returning laden, about the same period, as the stream would be favourable to Dacca, and from thence in the tide way. "Assuming however, two months as the time necessary to complete a voyage, including loading and unloading, it strikes me," says Major Carter, "2½ annas per maund should nearly cover the carriage, and below I give the grounds of my opinion. A thousand maund boat can be hired at

per Mensem..	30	0	0
" 10 Dandies at 3 Rupees each,............................	30	0	0
" 1 Manji at 4 Rupees,......................................	4	0	0
	64	0	0
			2
	128	0	0

This boat should carry 800 maunds, which just gives 2 annas 6½ pice per maund, so that at this rate Cherra coal ought to be delivered in Calcutta at 7 annas per maund; Major Carter therefore expresses his surprise that an offer recently made by the Marine Board, of 9 annas for Cherra coal, had not been taken up, and suggests that if boats of 2 or 3000 maunds, such as are used for bringing wood from the Sunderbunds, were employed as far as the rivers would admit, the carriage would be still lower.

The readiness with which boats may be had for any regular trade, may be imagined by the following observation of Major Carter:—"Hundreds of large boats frequent the Sunderbunds, nearly as far as Dacca, in search of cargoes of rice and dhan, the worth very little more in ordinary years than coal, and the latter scarcely one half as valuable; they do not find their cargoes at one place, or belonging to one person, but attend the banks, and purchase in whatever quantities the people bring to the market, often only a few seers, and seldom exceeding a few maunds."

The Commissariat regulations, and general custom of paying boat-hire on a computed distance instead of the time actually employed, might in the first instance militate against the economy of any arrangement for hiring boats, says Major Carter; but if a few boats were purchased or built at Dacca or in the Sunderbunds, and manned by a private individual, the result would prove the correctness of these calculations. A good boat could be built for 500 rupees, and in six trips, at the above rate, would yield 300 rupees, leaving 60 for casual repairs, this would repay itself in less than two years; but a boat is expected to last seven or eight.

Cuttack.

About ten years ago a specimen of coal found in the Cuttack district was sent to the Asiatic Society, probably with some particulars which do not appear to have been noted in the proceedings; the circumstance was however suggested to the Committee by Captain Jenkins, in 1837, and soon after Lieut. Kittoe, then with his regiment at Cuttack, obtained a specimen, together with some particulars which he communicated to the Committee; on which he was requested to visit the spot, when he collected the following particulars. Half a mile from the Fort of *Talcheer** coal seams are exposed along the banks of a small *Nulla* called *Belajooree* (at a spot where workmen employed by Mr. G. Becher, had a few years before extracted some specimens of coal). Mr. Kittoe formed an excavation to the depth of 15 feet, in which he found at a depth of 13 feet a bed of "good glistening coal," 1 foot to 1½ foot thick, reposing beneath ten feet of "*shingle*" and two beds of shale and blue clay, each 1½ foot thick. The latter, as well as a grey rock beneath the coal, both containing fossil plants.

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* Talcheer is a town on the Bramenee river, 140 miles from the coast.

Mr. Kittoe states, that a native contractor offered, in the event of coal being raised at Talcheer, to convey it down the Bramenee river to *Himsuagola*, on the coast, where large sloops may anchor, at four annas per maund; but Mr. Beetson, the contractor for the transport of salt from thence to Calcutta, was of opinion, that two annas per maund at the utmost would be sufficient. From the coast to Calcutta the transport of coal would be the same as that of salt.*

The next coal to which Mr. Kittoe by his guide was conducted, is a few miles higher up the Bramenee, and at a distance of sixteen or eighteen miles from that stream, so that its conveyance would be considerably more expensive. The coal is here exposed for a mile on either side of a nulla called *Sungurra*, a tributary of the Bramenee, averaging in height from five to fifteen feet above the sand. The country is said to be level from the coal to the bank of the Bramenee, so as to afford every facility for the construction of either a road or a canal. Iron ore is found in great abundance throughout both these coal districts, and the ore is smelted to some extent, and by the same process as that which prevails in other parts of India.

Such is the substance of Mr. Kittoe's Report.† The specimens of coal furnished were not of good quality. Three specimens of Talcheer coal examined at the Mint, afforded the following average results:—

Specific gravity, ...	1.3610
Volatile matter, ...	39 0
Carbon, ...	44 1
Earthy matter, ...	15 10
	100 0

Talcheer and Hingolar may be regarded, we think, without much doubt, as an extensive and valuable coal field. The workable beds will probably be found to be some distance from the surface at the spots visited by Mr. Kittoe, but the district appears to have been subject to so much local disturbance, that more favourable positions for coal mines may be expected, when the country has been properly examined.

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* At present there are three contracts for the conveyance of salt from Hunsew to Calcutta; the rates are 18 Rs., 17 Rs. 8 annas, and 17 Rs. per 100 maunds.

† Vide Asiatic Journal of 1839. pp. 137—144.

Since the above remarks were written, the Committee have received a communication from Mr. Mills, the Commissioner of Cuttack, enclosing a report from Mr. Beetson, whom he deputed on 22d February last, at the instigation of Mr. Smith, the President of the Coal Committee, in order to procure further information on the subject. Mr. Beetson reports, that " the samples laid before the Committee by Lieut. Kittoe, were far inferior to those I have now brought with me. The latter are equal to the best Burdwan; but to satisfy the Committee as to its description and quality, if Government will pay the expenses, which will amount to a mere trifle, I shall be happy to undertake the delivery of one or two hundred maunds in Calcutta by next December." Mr. Mills observes that the specimens, as far as he and other gentlemen at the station are able to judge, are so very good, that he authorized Mr. Beetson to procure 100 maunds for trial in Calcutta. This coal is derived from the second, or more distant coal field visited by Mr. Kittoe. The locality in which the coal occurs is, according to Mr. Beetson, called *Gopal Pushad*, and the nulla by which it is laid bare, *Sangra*, which corresponds with Mr. Kittoe's name *Sungurra*. Mr. Beetson states, that the distance from Gopal Pushad to Talcheergur is from fourteen to sixteen miles, and recommends that the coal be carted by buffaloes (the common draught cattle of the country) to Talcheergur. From Talcheer the coal could then be conveyed in ten or twelve maund boats to Kumalung, six miles below Talcheergur, where it should remain till the setting in of the rains, and from thence it may be conveyed for six months of the year in from 100 to 300 maund boats to Hunsuah on the coast, where it would be available for sea-going steamers at from three to four annas per maund. From Hunsuah, Mr. Beetson would undertake to convey the coal to Calcutta at 18 Rupees per 100 maunds, and indeed he thinks he could supply it to the Calcutta market at six annas per maund, including every expense.

Adji.

Since our last report, little has been elicited regarding the northern boundary of the Burdwan coal field, where the beds advance towards the Adji river. Mr. Erskine in reply to a circular from the Committee, dated October, 1838, recapitulates the different places at which coal has been found. Mammudpore is the most eastern situation. The pits are here four or five miles from Seedporeghat. The mineral is better to the westward at Parihorpore, about ten or twelve miles above Seedpore. Seedpore is eighteen miles from Cutwa or Culna on the Hooghly, and the river is pretty open during the rains for boats of 400 maunds burden from Maulyghat to Cutwa, a distance of forty miles. The upper portion of the river rises and falls suddenly, so as to render it difficult to manage a larger boat than 200 maunds. Mr. Erskine observes, that considering the difficulty of the Adji navigation, and the scarcity of boats at present, and also the high price that it would be necessary to offer to boatmen to induce them at first to undertake the carriage of coals; he does not think the coal could be delivered at Cutwa under four annas per maund. Should the regularity of the employment induce people to build more boats (as has been the case on the Damooda,) prices might fall to about 3 annas per maund. Adji coals are now used for the Dhoba Sugar Works to the extent of 10 or 15,000 maunds per annum.

Rajmahal.

When our last report was written, coal was known to exist in two situations only in the Rajmahal hills; namely, Sicrigully and Hurrah. In April 1838, Major Forbes was informed by Mr. James Pontet that he had found a bed of coal in the Rajmahal hills, on the banks of a nulla called the Bramenee, sixteen miles distant from the water carriage during the rains, about thirty miles west of Moorshedabad, and nearly in the line of the canal proposed by Major Forbes. A specimen of this coal afforded the following on analysis:—

Specific gravity, ...		1.370
Volatile matter, ...	42 0	
Carbon, ...	44 8	
Earthy matter, ...	13 2	
	100	

A sample consisting of a few maunds furnished by Mr. Pontet sometime before to Mr. Scott, the commander of the Jumna steam vessel, also proved of favourable quality. Mr. Pontet having been desirous of procuring the means of extending his observation, these were provided, and on the 20th June he dispatched ten bags of coal to Calcutta, this also proved favourable; but a subsequent dispatch of 400 maunds consisted of shale and inferior coal. In explanation of this last unfortunate circumstance, Mr. Pontet stated that the necessary aid did not reach him till the rains had set in, when the place being unhealthy, he was obliged to leave the raising and dispatch of the coal to inexperienced natives.

The following is an extract from Mr. Pontet's letter, in which he describes the operations in which he was engaged—"After the first vein of coal, we came upon a hard black stone, and finding the operation of boring through it so very tedious, I took upon myself to select a spot for a shaft, and procured well-diggers, and stone-cutters, who have been for the last two months at work, at present to all appearance with satisfactory prospects, as one of the stone-cutters who opened a shaft at Burdwan says this mine bears some resemblance to it. I am induced to persevere a few feet more, in hopes of coming to a useful vein. The first twenty-three feet of soil is red and black earth mixed with kunkur, and under that, to a depth of forty feet, are thirteen different *strata*, three of coal, and the rest various kinds of stone." Mr. Pontet transmitted to the Committee specimens of all the different beds passed through, which are remarkably characteristic of the true coal measures; and of eleven different beds passed through in the last seventeen feet of the excavation, three were coal of good quality, but too thin for working, and in the shale we observed excellent specimens of *Vertabrea Indica*, one of the few abundant fossils of the Burdwan beds that happens to have received a name.

The excavation was formed on the N. W. side of the Bramenee nulla; but Mr. Pontet states that he traced the coal a mile S. W. of the Bramenee river, from which he concludes that the Burdwan and Rajmahal beds are connected

Soan River.

In a letter from Mr. Ravenshaw, Officiating Commissioner of Patna, to the Government of Bengal, dated 6th January last, that gentleman states that a Cazee had found a bed of coal at a place called Chupree, four miles from the Soan, near its junction with the Koila, and estimated the expense of delivering coal from this bed to Dinapore to be five and a half annas per maund. On this information 300 rupees were advanced to the Cazee to enable him to commence operations; but after extracting 100 maunds, precisely similar to Palamow coal, the bed assumed a slaty character, and the Cazee abandoned his operations. If the Cazee's statement regarding the existence of coal so near the Soan be correct, the circumstances under which it occurs ought to be fully investigated.

Palamow.

Mr. Tytler, an engineer employed under the Controller of Steamers, having been deputed, under the authority of the Marine Board, to Palamow, describes a bed of coal six feet thick, exposed to a great extent on the banks of the Amanath river, where Mr. Homfray a short time before could only find a 3½ feet bed, so interrupted by ravines as to render the field very limited. There is however evidence enough in the reports of Major Sage, and Mr. Tytler, as well as in the information furnished to Mr. Ravenshaw, the Commissioner of Patna, to show that coal is here abundant enough, the only doubt is as to its quality. The samples of Palamow coal that we have seen have been vitiated by the inexperience of the miners with an intermixture of shale, so as to render them unfit for trial. Major Sage, Executive Engineer, Dinapore, states that he had formerly been in the habit of receiving supplies of coal from Palamow, which he considered a good and useful fuel. We have no doubt that a good coal may be procurable in Palamow, but such samples as have been hitherto sent to Calcutta for trial have been inferior, partly no doubt from their having been ill chosen from the numerous beds that seem to occur in that district. Major Sage found the following results from comparative experiments instituted between Palamow and Burdwan coal, from which it would appear that the former has the advantage in point of quality.

	Palamow.	*Burdwan.*
Coke,	46 2	46 2
Volatile matter,	47 0	40 0
Earthy matter,	6 8	13 8
	100 0	100 0

In experiments of this kind on a small scale, every thing depends on the specimens selected for comparison. The Burdwan coal varies in quality in different mines, just as Palamow coal would vary if mines were once fairly established in that district.

The best Burdwan coal we can induce the contractor who supplies the laboratory of the Honorable Company's Dispensary to furnish, affords 25 per cent. of ashes, but the kind used on board steamers is said to be very superior to this, and the Ranygunge variety with which other coals are compared, is the best in Burdwan. Much judgment is therefore necessary in selecting samples for trial from new coal districts, when the object is to compare them with Burdwan coal. Whatever coal it has been customary to use will always have the advantage of a new coal in such trials, in as much as the form of the furnace, and the manner of keeping up the supply will be such as are suited to the old coal, while the necessary experience is wanting with regard to the most favourable circumstances for burning the new.

If the draught of the furnace be too great for the coal, the fire will burn down too rapidly, and the coal will be wasted in an unnecessary quantity; and if not sufficient, the fire will burn too slowly, and the stoaker perhaps accustomed to throw in fresh fuel at certain intervals will keep the fire choked, so as to require more frequent stoaking than necessary, and (as Colonel Presgrave remarked on the late trial of Palamow coal) every time the door is opened for this purpose, a volume of cold air enters, the effect of which is to lower the steam.

On board the Jumna steamer, 13th March last, three samples of Palamow coal were tried, one furnished to Mr. Ravenshaw by Cazee Mohumdec, mixed however with Chupree coal, and the other two from Mr. Tytler; the first seemed to answer best, though evidently raised without judgment, and mixed with shale. The faults of this compared with the best Burdwan coal were, that it required a much larger quantity to keep up steam, and that it ran into slags or clinkers, which choked the bars of the furnace. This last effect may have been owing to the coal being mixed,* and perhaps would not have taken place had the bars of the furnace been wider apart. Mr. Tytler's sample from Lower Miral appeared to burn very freely, but compared with the best Burdwan coal, twice the quantity was required to keep up steam. On a third sample from Upper Miral being tried, it was found that even with an excessive consumption of the fuel, it could not keep the engine at full work. The value of these experiments will however depend on two circumstances, namely, whether the samples tried were the best that could be chosen, and whether the furnaces of the Jumna are as well suited to the nature of the coal as any that could be constructed.

Mr. Ravenshaw thinks he can procure a contract for the supply of Palamow coal at Dinapore for six annas per maund, it would therefore be of some importance to have the question of its quality fairly set at rest.

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* A small quantity of carbonate of lime or soda would have the effect of rendering the earthy parts of coal fusible. We think in another trial of Mr. Ravenshaw's mixed coal we could easily select the pieces which formed slags from the general mass, as they are covered on the surface with an efflorescence of soda. We think they belong to Singra one of the Palamow beds, and the peculiarity is probably very local.

Assam.

A report having been furnished on the subject of the Assam coal beds since the last general reports of the Committee were written,* there is little to say on the subject. Lieut. Brodie, principal assistant to the Commissioner, found coal of good quality about a year ago in a very favourable position on the Disung river, a specimen of which was forwarded to the Committee in July last, and found to afford—

Specific gravity, ...	1.3
Inflammable matter, ...	40
Carbon, ...	55
Earthy matter, ...	5
	100

We believe the Assam Tea Company are already about to open a colliery in this situation, with the intention of keeping a depôt supplied from it at Dikoo Mookh, on the main river.

Mr. Brodie had before found two and a half feet bed of coal about three and a quarter of a mile above the falls of the Jumna. A boat on average would reach the falls from Gowahattee in twenty days, and return in ten. Some years ago coal was raised by Mr. Bruce, under orders of the late Mr. Scott, from beds near the banks of the *Suffry*, a tributary of the Disung; on trial *this proved to be the best coal ever found in India*, but the situation was inconvenient, the Suffry being unnavigable at all seasons, and a small ridge of hills would render the formation of a hackery road difficult. In February 1838, Captain Jenkins found two beds of coal, one of them 100 yards in length, and eight feet in thickness, projecting from the banks of the Disung river about a mile above the village of Boorhath; the other situated in rising ground, about a quarter of a mile from the first, was exposed for 200 yards in length, and numerous small springs of petroleum emerged from beneath it. From these Captain Jenkins' servants collected about five seers of petroleum in a few minutes. The Disung is navigable for six months of the year.

Beds of coal were also observed by Captain Jenkins at Jeypoor, about ten miles east of Boorhath, on the Bora Dihing river, a quantity of which was raised by Captain Hannay and sent to Calcutta, but not approved of. Like all similar experiments on the quality of coal the results proved little, especially as we now understand the Assam Tea

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* Published in Journal As. Soc. 1838, pp. 948, 959.

Company have established a colliery in this situation,* in addition to the one already alluded to on the Disung; thus two principal depôts will be supplied on the main river at Debru and Dikoo, from distinct coal districts capable, if necessary, of supplying other depôts along the whole line of the Bramaputra.

An excellent coal was found by Lieut. Bigg and Mr. Griffith on the Numroop river, in Upper Assam, and Mr. Bigg states that immediately opposite the village on the west of the river is another range of hills similar to those in which the coal is found; in these they found eight or ten springs of petroleum.

Nerbudda.

With regard to the Nerbudda coal, the Committee have received no communications since their last reports were laid before Government, but it appears to have been since tried at Bombay, and found to be of very excellent quality.

Specimens of coal were found by Captain Burnes during his mission to Cabul in 1838, in the following districts, viz., 1. Shukurdura, near Kala Bagh, where it occurs in a hill two miles south of the village, and other situations in the neighbourhood; distance from the Indus about 15 miles. 2, near Muckud, locality doubtful. 3, fifteen miles SSE. of Cabul near Moozye, in the vicinity of copper mines. 4, Jamoo, in the Punjab, near the Chenab, where it would be as valuable as if found on the Indus. 5, between Tak on Kaneegoorum, NW. of Dera Imael Khan, 1½ coss East of the small village of Sungarkhyle, in the neighbourhood of the Indus, where the country is said to be poor, and labour cheap. Captain Wade, Political Agent at Lodiana, also found specimens of coal in the Maundi Hills north of the Sutlej: more recently we believe Mr. W. Jameson, whose observations will be of peculiar value in every point of view, has found extensive tracts belonging to the coal formation, approaching as near to the Indus as he had been able at the time he wrote to carry his inquiries.—*Journal of the Asiatic Society of Bengal*, No. xcviii—1840.—pp. 198—214.

(*Signed*) J. M'CLELLAND,
Assistant Surgeon,
Secretary Coal Committee.

4th April, 1840.

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* As well another at the place.

XIV.—NOTICES OF BOOKS

1.—*Illustrations of Indian Botany; or, figures illustrative of each of the Natural Orders of Indian Plants, described in the Author's Prodromus Floræ Peninsulæ Indiæ Orientalis.—By* ROBERT WIGHT, M. D., F. L. S., *&c. Surgeon on the Madras Establishment.—Madras, Published by* J. B. PHAROAH, *for the Author:*—Quarto pp 218. vol. 1st.

2.—*Icones Plantarum Indiæ Orientalis, or Figures of Indian Plants.—By* ROBERT WIGHT, M. D., F. L. S., &c. *Surgeon on the Madras Establishment.—Madras, Published by* J. B. PHAROAH, *for the Author:*—Nos. 1 to 16, vol. 1st.

The first volume of that excellent and highly useful work, the *Illustrations* of Indian Botany, is completed with the 13th number. In the prosecution of his plan the indefatigable and talented author has illustrated sixty-two of the Natural Orders. The descriptive accounts of the botanical relations, economical uses and medicinal properties of the plants, with descriptions of recently discovered and imperfectly known species, are ample, and are of the highest practical value and importance, to the physician, to the agriculturist, and to commercial men, as well as affording, aided by the *Icones*, to the Systematic Botanist all that he desires in illustration of the Flora of the extensive and interesting region of Peninsular India.

The pictorial illustrations of the 1st volume amount to 100 in number; they are lithographs, executed at Madras, in a style highly creditable to the state of the arts in India; and coloured, under the author's eye, by native artists.

The *Icones* may be considered, in the author's language, a *pictorial index* to the *Prodromus Floræ Peninsulæ Indiæ Orientalis.* They are uncoloured outlines of all the species which Dr. WIGHT's own collection enables him to give drawings of, or copies from ROXBURGH's and other expensive and little known works.

These two works, then, it will be seen, are unparalleled in the history of scientific publication for comprehensiveness and utility.

With the 13th number of the *Illustrations* are published a *Dedication* to the Right Honorable JOHN *Lord* ELPHINSTONE, Governor of Madras; a *Preface* and *Introduction;* with an *Index*, &c. to complete the volume. From the *Preface* and *Introduction* we shall borrow largely, as they tend to exemplify the scope and objects of the author's works now under review, as well as to develope the progress and present state of botanical science. From the body of the work it is of little use to commence extraction, for we should be tempted to go on until we had transferred the whole to our pages. The object of this notice is to do all in our power for the extension of the study of Botany through the assistance of Dr. Wight's admirable publications, of which we confidently anticipate an extended circulation; for we are grieved and astonished to find from the author's preface that it needs a "continuation of support from the public, without which it is impossible his contracted means can bring it to a close, as it has already involved an outlay so much beyond its returns, that, but for the liberal aid of Government, in patronizing it and its fellow, the *Icones*, to the extent of fifty copies each, both must long ago have ceased to exist."

" In the Preface to the Prodromus Floræ Peninsulæ Indiæ Orientalis, will be found a brief historical sketch of the rise, progress and present state of Indian Botany. From that sketch it will be perceived that, until the publication of that volume, every work since the time of Linnæus, with the excepton of DeCandolle's *Systema Vegetabilium* and *Prodromus Systematis*, treating of Indian plants, was arranged according to the Linnæan sexual or artificial system. It has naturally followed that nearly all those who had devoted their leisure to the investigation of Indian plants have adopted that system, and find the study of them according to their natural affinities often exceedingly difficult, if not actually irksome, even though the advantages of the latter over the former method so greatly preponderate as scarcely to admit of any comparison being instituted between the two. Instigated, therefore, partly by a long cherished wish to promote the extension of Botanical pursuits by diffusing a knowledge of species, partly by the desire of lessening to others the difficulties which beset my own path when passing from the one methed of study to the other; but principally in the hope of being able to show that, for the attainment of a correct and comprehensive knowledge of the properties and uses of plants, whether as food, medicine, or in the arts, a much more direct and certain method is, through an enlarged and philosopical acquaintance with their natural affinities, than by the most laborious, but empirical search for individual properties, when entered upon without any such guide as the knowledge of affinities supplies to our researches. To elucidate these affinities, and at the same time to furnish the Indian Botanist with the means of identifying species, this work and its companion, the " Figures of Indian Plants," were undertaken, and, even at their present early stage, the author has reason to believe with much advantage towards the accomplishment of this design.

"According to the natural arrangement, all plants, whether of a province, a kingdom, or of the whole world, agreeing in certain ascertained peculiarities of structure, taken not from one set of organs only, but from every part of the plant, commencing with the root and ascending to the perfect seed, are grouped together as one order or family, under a name derived either from a prominent genus of the group or from some striking peculiarity of the order (*Ranunculaceae* from Ranunculus: *Cruciferae* from their cruciate flowers: *Leguminosae* from the leguminous fruit, &c.). Such groups, if correctly associated according to their affinities, that is organic structure and physiological peculiarities, would, it was presumed, be found to participate in the kind and qualities of secreted products which result from the operations of organic life.

"In this anticipation the philosophical investigator of nature has not been disappointed; for, so constantly does the fact agree with the theory, it is now known, except in rare instances, plants referable to different families will not graft on each other, apparently because the juices elaborated in different families of plants, though growing side by side, in the same soil, are so different in their qualities, that those of the one are unfit to nourish a branch taken from the other: while, on the other hand, two plants of the same natural family, however much the soils in which they respectively grow may differ, can generally be readily grafted on each other. From the same cause, the action, namely, of organization on secretion, we find, in a great many instances, identical properties common to whole families of plants. Acrimony predominates throughout the *Ranunculaceae* and *Cruciferae:* narcotism is the characteristic of *Papaveraceae* and *Solanaceae: Apocyneae* are generally poisonous, and some of the species most virulently so: astringency is common to nearly all the arboreous *Mimoseae* as well as to many of the *Caesalpineae*, it equally predominates in *Terminaliae*, and the whole of the genus *Quercus* is pre-eminently marked by that property. The *Cucurbitaceae*, *Convolvulaceae* and *Euphorbiaceae* are equally distinguished by properties the very reverse, the action of many species of each of these orders being violently drastic. The fruit of *Rosaceae* and seed of *Leguminosae*, on the contrary, are so universally wholesome, that it may be laid down as a general rule, almost without exception, that they may be safely partaken of whenever they are met with.

"These few examples will suffice to show how vastly the study of properties is facilitated by an acquaintance with natural affinities, and will I trust, at the same time serve to remove an objection which I have more than once heard urged against this work, that it did not sufficiently, treat of Medical Botany. This objection could only be raised by those who did not sufficiently consider that its object was to establish principles on a scientific basis, as being the true way to attain the object sought for. There is no royal road to science, and until the medical man studies the principles of Botany as a science, he need never expect, through an inspection of plates or specimens of medical plants, to become a medical Botanist. But with only an elementary knowledge of Botany, such, for example, as a perfect knowledge of the structure of the flower and fruit, an acquisition not generally of very difficult attainment, the case is widely altered; since any one who had advanced so far in the knowledge of the elements of the science may easily make himself master of the characters of a few species of an order, and then he can generally trace its relations with nearly allied orders, or even recognize some of them from family likeness alone. Having ascertained the order of the plant under examination, the subsequent steps leading to the attainment of a comprehensive knowledge of its name, history and properties, are comparatively easy; and not of it only, but of the whole order. It is true, that to acquire a thorough acquaintance with an order, frequently requires the student to examine and carefully compare several, but every plant so examined facilitates subsequent researches, and lessens the difficulty of the next step, that, namely, of making out the genus. But even without going so far, having once determined the order of a plant, we are in possession of a fund of information; since but little further trouble is required to make ourselves acquainted with all that is yet recorded respecting that order, and to ascertain whether any applications we have learned are still unknown to science. The natural method, in short, gives both precision and extension to any enquiries we may undertake respecting plants, whether considered with reference to organic structure and its modifications, the products of organic life in connection with structure, or the applications of these products to the comforts and conveniences of life; and thereby to the advancement of civilization among men The difficulties to be surmounted at the outset of the study are no doubt often great; those, namely, of determining the order of a plant when it departs from the normal structure of the order to which it belongs: but even then, a futile search is not unattended with advantage, as the examination puts us in possession of much useful information, which will materially assist our future research, should we be necessitated to turn to the artificial system to find its name.

" Should we, on the contrary, commence our examination with the artificial sexual system, the first step, that of determining the class and order of a plant, is the easiest; but, that done, it often happens that nothing is learned: for, should the specimen under examination have a stamen or style more or less than the regular number, and nothing is more common among tropical plants, we look in vain in the class or order, where, according to our specimen, it should be found; and, when found, still that system conveys no collateral information regarding the relations of the plant, or of the nature of the properties with which it may be endowed.

"In drawing these comparisons, it is not my wish unduly to exalt the one at the expense of the other, for in truth they are so very different that it is impossible to compare them; they both have their advantages and disadvantages, and, in the present state of the science, are both necessary: I certainly think, however, the preponderance of good is greatly in favour of the natural method. In thus giving the preference to that system which enables the student, who has made considerable progress in its study, to look over a large collection of plants, not one of which he had ever seen before, and readily refer probably as many as 19 out of every 20 to its proper natural order, from family likeness alone, I am far from as yet wishing to see the other altogether exploded, since by it we are often enabled quickly to determine abnormal plants that we could not so easily have done by the other; and, in such cases, I still occasionally find the advantage of having formerly become familiar with the Linnæan system. Though to this extent I approve of it, I could not recommend it for general use, as its natural tendency is to contract our ideas, by concentrating our attention too exclusively on one set of organs, and confining our enquiries to the investigation of the names of species only, in place of, as is the case with the other, expanding them with the growth of our knowledge, by extending our researches, from the examination of species, to the investigation of masses in all their bearings.

"While for these cogent reasons, we are, in the present advanced state of the science, gradually permitting that once celebrated system to drop into oblivion, we must not forget how much Botany is indebted to it for its present advancement. The extent of these obligations can only be justly appreciated by comparing the botanical works of its great author with those of his immediate predecessors, not one of the plants described by whom can now be made out from their descriptions, unaided by some collateral circumstance, or by plates, and too often, even with these aids, they are still unknown. Immediately on its introduction into practice, order supplanted disorder, arrangement and method succeeded and dispersed the previous confusion and perplexity, as light disperses the darkness. From this hour materials accumulated with unprecedented rapidity, and have continued to do so to such an extent, that the catalogue of known plants which, on the most liberal computation, did not, at Linnæus' death, exceed 12,000, is now but little if at all short of 100,000 species. To this increase the natural method owes much of its present admirable precision, as, without such a mass of materials, innumerable breaks in the chain of affinities must still have existed, marring both its beauty and usefulness. We may thence I think fairly conclude, that the sexual system of Botany, however defective in scientific precision and comprehensiveness of design, was yet of incalculable benefit to the science; the impulse which its beauty and simplicity communicated, calling thousands of enthusiastic votaries into the field, by whose joint labours was collected the vast mass of valuable materials of which the more philosophical natural method was constructed: leaving altogether out of consideration, the justly admired nomenclature and precision of language appropriated to the description of plants introduced by its author—the universally acknowledged father of modern Botany—Linnæus.

" Having I trust satisfactorily shown that the essential difference between the two systems lies in the tendency of the one to contract our ideas, by attaching an undue value to the knowledge of species, while that of the other is to elevate and expand the mind by imparting a knowledge of and leading to the contemplation of masses, I believe I have said all that can be required in support of my preference of the natural system, and of the propriety of my first determination to publish a flora of this portion of India arranged according to that method. The same reasoning equally establishes the propriety of my entering on the present work, explanatory of the principles of that system, and showing its application to the grouping in masses of the knowledge which has for ages been accumulating as detached observations; but which, until thus concentrated, was of difficult access, and, when obtained, only applicable to the species to which it originally appertained, in place of, as now, by affording so many points of comparison, or known quantities, enabling us to deduce useful applications of hitherto unknown plants, simply on the ground of their structural relationship or affinity in the system of nature to others, the qualities of which are well known.

" That many anomalies, nay positive contradictions, occur in our present groups, is undeniable; but it is equally certain that many of these are disappearing under the more rigid scrutiny of structural peculiarities, which have often shown, that the most striking departures from the general rule, were attributable, not to imperfections of the rule itself, but to erroneous associations of plants, either only remotely or not at all allied, in the same groups.

"The objects of this work may now be briefly summed up: they are, first, to explain the principles of grouping plants according to their natural affinities, and illustrating these by figures of species appertaining to each group: and, secondly, to show, by adducing a variety of examples of the fact, that, in a great majority of instances, similarity of structure, or botanical relationship, is accompanied with similarity of properties; and, lastly, to prove that these premises lead to the inference, that, having ascertained by careful examination and comparison its nearest botanical relatives, the properties of which are known, we are often enabled to infer the properties of an imperfectly known plant. In addition to these more immediate objects, I have endeavoured to render it a supplement to our Prodromus, by a running commentary on that work, and by the description of such new species as have come into my possession since its publication. To render the information thus embodied in these pages as easily accessible as possible, I have added a very copious index, including every name and noting every page where it occurs. By this means any one is enabled, with little trouble, to trace a family through all the relations, whether botanical, economical or medical, in which it occurs in these pages."

Introduction.—"It is laid down as an axiom by some eminent modern Botanists, 'that nature only creates species, and knows nothing of a natural system of Botany.' This, it is added, is entirely a human contrivance, founded on a consideration of the resemblances existing between the parts, properties and qualities of plants, according to which their affinities are determined, and species, having the greatest degree of relationship in all these particulars, are placed next each other, in such a way, that the qualities or intimate structure of an imperfectly known plant, may be inferred from a careful consideration of the known qualities and structure of those nearest to which its botanical characters would place it, in a system constructed on these principles. Whether or not this theory be just, I will not stop to enquire, for, so long as the object is obtained, I feel quite satisfied that the method by which we attain it, whether a mere human contrivance or the work of nature herself, is so infinitely superior in its fitness for the supply of human wants, and for furnishing matter for philosophical enquiry, to all the artificial ones that have gone before, that there can be no hesitation as to the propriety of its instant adoption, whatever may be the difficulties to be, in the first instance, surmounted in acquiring a knowledge of its principles. These, in the present instance, are not by any means so great as they have been represented; for, as Jussieu well observes, whatever trouble is experienced in remembering or applying the characters of natural orders, is more than compensated by the facility of determining genera, the characters of which are simple in proportion as those of orders are difficult. The reverse takes place in arbitrary arrangements, where the distinction of classes and sections are simple and easy to remember, while those of the genera are in proportion numerous and complicated. On this question, therefore, as there can scarcely be two opinions, it now only remains for me very briefly to explain the principles of the arrangement or distribution of the orders, adopted both in this work and in our Prodromus.

" The arrangement followed is very nearly that of Jussieu, as modified by DeCandolle, and adopted in his Systema and Prodromus. According to this system, all plants are first distributed under two principal classes, CELLULAR and VASCULAR, the former comprehending all the plants destitute of spiral vessels and of Cotyledons—CELLULARES; the latter, including all the flowering plants which are furnished with both these organs—VASCULARES. The vascular plants, of which only we have as yet treated, are again divided into two classes—DICOTYLEDONS or EXOGENOUS plants, and MONOCOTYLEDONS or ENDOGENOUS plants. To the former, all trees and shrubs which increase in thickness from the centre towards the circumference by a succession of concentric layers of wood, belong, as well as nearly all those herbaceous annuals, the leaves of which have reticulated or anastomosing vessels. To the latter the various kinds of grasses, Lilies, Orchidiœ, Palms, Plantains, &c. belong; the vessels of the leaves of which pass either in straight lines from the base to the apex, or from the midril to the margin, and the leaves are sheathing, in place of being attached by a joint to the stem. These distinctions are not without exceptions; but the exceptions are so few as scarcely, in practice, to affect the value of the rule. These primary divisions, though thus based on the most obscure and difficult portions of vegetation to investigate, the minute structure of the seed and organization of the stem, are, in fact, the easiest, generally speaking, of determination ; the simple circumstance of a plant having a flower, proving that it has spiral vessels, while the practised eye of a botanist can, almost invariably, tell at a glance, by merely inspecting the distribution of the vessels of leaves and structure of the stem, whether the seed is mono: or dicotyledonous. Having, by this summary process, decided to which division of the system a plant belongs, we proceed with our investigation. Let us suppose the plant is dicotyledonous, and that we still follow DeCandolle as our guide.

" He divides *Dicotyledonous* or *Exogenous* plants into four subclasses, the characters of which are taken from the fructification. These four are respectively named *Thalamifloræ*, *Caliciflora*, *Corollifloræ* and *Monochlamydeæ*.

I. " *Thalamifloræ* are distinguished by having several distinct petals and stamens inserted on the Thalamus or receptacle of the flower, and not cohering with the calyx.—(flowers hypogynous).

" The petals and stamens do, however, occasionally cohere; as, for example, in *Malvaceæ*, so as in some degree to resemble those of the third class, *Corolliflorae*, from which, however, in all such cases, their numerous, nearly distinct, carpels distinguish them.

II. " *Calyciflorae* have also several petals, either distinct or united to each other, but inserted along with the stamens on the calyx, usually through the medium of a disk lining its tube or concave portion.—(flowers pyrigynous or epigynous).

III. " *Corollifloræ* have the petals united into one, bearing the stamens, and inserted on the thalamus, or receptacle (hypogynous).

IV. " *Monochlamydeæ* have either no corolla, or the petals, if present, are united to the calyx, forming together a single, not double, perigonium or verticel of flower leaves round the pistil.

Before going further it may be proper to observe, that this is a mere artificial classification, intended simply to facilitate the arrangement of the orders in a linear series, and to aid in enabling us to determine to what part of that series we ought to turn to find the order of any plant under investigation. While it pretty well fulfills these objects, it must be acknowledged, that, like all such artificial combinations, it is liable, on the one hand, to produce unnatural associations; and, on the other, to separate orders most nearly allied; besides presenting examples of monochlamydeous and dichlamydeous genera in the same order. These objections, however, apply to the arrangement, only, of the orders, not to the orders themselves, which may, though individually perfectly natural, be most unnaturally placed in relation to each other; a defect, to which all systems yet proposed are more or less liable, and, we may almost assume, ever will be, when we take into consideration that families of plants, like provinces of a kingdom, touch each other, not by one point only, but on all sides, and that we might as well expect to arrange the latter in a correct, linear series, as the equally irregularly formed and closely surrounded provinces, that is the natural orders, of the vegetable kingdom. All, therefore, that can be looked for, are well constructed and correctly defined orders or provinces, the boundaries of which should be as clearly marked out as the nature of the subjects will permit. Then comes the arrangement of these, in such a manner as to facilitate reference, or, to follow out the simile of kingdoms and provinces, to teach under what latitude and longitude we must look, first for the province (the natural order), and then for the town (the genus), to which the subject of our enquiry (the species) belongs. Various plans have been tried for the attainment of this desideratum, but no one seems yet to have obtained such general favour as the one the ground work of which I have sketched, even though liable to such striking defects as those I have indicated. But to proceed.

I. " THALAMIFLORÆ.—This sub-class includes all the plants originally referred by Jussieu to his 13th class (Polypetalæ hypogenæ), those, namely, with hypogynous or inferior flowers, and several petals; or which has more recently received the name of Hypopetalæ, that is, petals inferior to the pistil or ovary. This is a large class, presenting many anomalies; but, upon the whole, generally of sufficiently easy application in practice.

II. " CALYCIFLORÆ.—This sub-class is more difficult, and often not easily distinguished from either the preceding or the succeeding one. It is divided into six sections.

1. " *Peripetalæ*, with several distinct petals inserted on the calyx towards its base, leaving the ovary superior or free—*Leguminosæ*, the section *Potentilleæ* of *Rosaceæ*, and *Salicarieæ*, all afford easily understood examples of this section.

2. " *Epipetalæ*.—In this section the tube of the calyx is prolonged and lined by the torus, which forms a small disk on the summit of the ovary, and the ovary is enclosed by and coheres with the calyx tube: the distinct petals and stamens are inserted on the outside of the disk. The ovary is here said to be inferior or adherent, and the flower superior. *Roseæ*, *Pomeæ* and *Combretaceæ*, apparently afford examples of this section, but want the disk on the summit of the ovary. *Umbelliferæ*, *Araliaceæ* and *Corneæ*, are the only orders referred here as being truly epipetalous.

3. " *Epicorallæ Corisantheræ*; this section differs from the last in having the petals united, forming a monopetalous corolla, bearing the stamens inserted on its tube, and the anthers not cohering round the style. The common honey-suckle is a familiar example of this section; to which also the elder, the coffee, valerian, &c., that is the orders *Caprifoliaceæ*, *Rubiaceæ*, *Valerianeæ*, &c. belong.

4. " *Epicorollæ Synantheræ;* the essential distinction between this and the preceding section consists in the anthers of this cohering by their edges, forming a tube round the style; and from the succeeding, by the corolla being inserted on the top of the ovary, not on the bottom or tube of the calyx.

5. " To this section the vast order *Compositæ* alone belongs; as examples of which it may suffice to mention the humble Daisy, the common Thistle, the Artichoke, the Dandelion, and gaudy Dalia, to enable every one to understand what is meant by a compound flower, the general flower of each of these being made up of a congeries of small ones.

6. " *Pericorollae;* in this, as in the two preceding sections, the petals are united into a monopetalous corolla, but in place of being inserted on the top of the ovary, it is inserted on the tube, or towards the base of the calyx; leaving the ovary either partially or altogether free.

" The Lobelia, the Hairbell, and Heath tribes, afford examples of this last section of the 2d class.

III. " COROLLIFLORÆ.—This sub-class differs from the three last sections of the preceding, in the insertion of the corolla only: like them the corolla is monopetalous, bearing the stamens; but, in place of being inserted on the calyx (perigynous), springs from the receptacle or base of the flower, inferior to the ovary (hypogynous): hence, in the language of Jussieu, the section is now named *Hypocorollae* (see table below).

" The Jasmines and Convolvulus afford the most familiar examples of this class, but the Gentians, Trumpet flowers (Bignonia), Heliotropes, Verbenas, Solanums (Brinjal, Potatoe, &c.) all belong to it.

IV. " MONOCHLAMYDEÆ.—This sub-class is characterized by having a single perianth, that is, only one verticel or whorl of floral envelopes, or if two are at any time present, the petals adhere to the calyx. It is divided into four sections.

1. " *Hypostamineae;* here the stamens are inserted on the receptacle, and the ovary is free, even though concealed within the tube of the calyx, to which it does not adhere. The Marvel of Peru (*Mirabilis Jalapa),* so much prized as a garden ornament, and the Amaranthus, appertain to this section. The flower of the former, often so delicately variegated, is in truth only a petaloid expansion of the calyx, and not a corolla, in the glabose inflated bottom of which, the filaments and ovary are found perfectly free. This lower portion of the calyx afterwards forms the black shell-like covering of the seed.

2. " *Peristamineae;* in this the stamens are inserted on the calyx, not hypogynous. *Chenopodium*, *Polygonum*, and the beautiful *Begonia*, are examples of this section.

3. " *Epistamineae;* here the ovarium is inferior, cohering with the tube of the calyx; stamens, inserted on the limb, or superior. *Santalum album* (Sandal-wood), and *Aristolochia* (Birthwort or snake-root) are well known examples of this section.

4. " *Diclines;* flowers unisexual or without a perianth. To this tribe are referred *Euphorbiaceæ*, *Urtiaceæ*, *Piperaceæ*, besides the Oak, Alder, Birch, Willow, Pine, Walnut, &c. Judging from the dissimilarity of the plants associated under this name, bearing in mind, at the same time, that several other orders in which diclinous flowers predominate are scattered through the system, it is to be hoped future researches will tend to break up this class, and, by the removal of some of the orders, will establish a more natural distribution of the remainder: some of those now placed here seem to have been referred to it, as to a lumber room, from not knowing where to dispose of them to greater advantage.

" For the remaining portion of the system *Monocotyledons* and *Acotyledons*, I shall refer for the present to the subjoined tables: the first exhibiting a *Clavis* of the system of Jussieu, the next, that system as modified by De Candolle, and adopted in our Prodromus.

I.—COTYLEDONS none.

Class 1. *Acotyledones.*

II.—MONOCOTYLEDONES.

2. *Monohypogynæ*, stamens hypogynous.
3. *Monoperigynæ*, stamens perigynous.
4. *Monoepigynæ*, stamens epigynous.

III.—DICOTYLEDONES.

§ 1. APETALÆ.

5. *Epistamineæ*, stamens epigynous.
6. *Peristamineæ*, stamens perigynous.
7. *Hypostamineæ*, stamens hypogynous.

§ 2. MONOPETALÆ.

8. *Hypocorollæ*, corolla hypogynous.
9. *Pericorollæ*, corolla perigynous.

10. *Epicorollæ synantheræ*, corolla epigynous, anthers united.
11. *Epicorollæ corisantheræ*, corolla epigynous, anthers free.

§ 3. Polypetalæ.

12. *Epipetalæ*, stamens epigynous.
13. *Peripetalæ*, stamens perigynous.
14. *Hypopetalæ*, stamens hypogynous.

§ . Diclines.

15. *Diclines*, flowers unisexual, or without a perianth.

A. DICOTYLEDONES, *Jussieu.*—Exogenæ, *De C.*

I.—THALMIFLORÆ, *De C.*—Cl. 1. Hypopetalæ, *Juss.*

II.—CALYCIFLORÆ, *De C.*

Cl. 2. Peripetalæ, *Juss.*
3. Epipetalæ, *Juss.*
4. Epicorollæ corisantheræ, *Juss.*
5. Epicorollæ synantheræ, *Juss.*
6. Pericorollæ, *Juss.*

III.—COROLLIFLORÆ, *De C.*—Cl. 7. Hypocorollæ, *Juss.*

IV.—MONOCHLAMYDEÆ, *De C.*

Cl. 8. Hypostamineæ, *Juss.*
9. Peristamineæ, *Juss.*
10. Epistamineæ, *Juss.*
11. Diclines, *Juss.* { § 1. Angiospermæ.
{ § 2. Gymnospermæ.

B. MONOCOTYLEDONES, *Juss.*—Endogenæ Phanerogamæ, *De C.*

Cl. 12. Monoepigyneæ, *Juss.*
13. Monoperigynæ, *Juss.*
14. Monohypogynæ, *Juss.*

C. Cl. 15. ACOTYLEDONES, *Juss.*

§ 1. Ductulosæ, *Arn.*—Endogenæ Cryptogamæ, *De C.*
§ 2. Eductulosæ, *Arn.*—Cellulares, *De C.*

" Of this system I have only further to observe, that the three primary divisions, Acotyledons, Monocotyledons, and Dicotyledons, are strictly natural, and must always be retained in every botanical system professing to arrange plants according to their affinities. So much cannot be said for the classes; they rest, with one exception, on a single point of structure, not in itself invariable, in the respective classes; the insertion, namely, of the stamens and petals, whether hypogynous or perigynous, points not always determinable without the aid of analogy. The secondary divisions, according to which the classes are grouped under four sections, are still more artificial and more liable to vary, and thence so much the less to be depended upon. Though to this extent artificial, this method of arranging the almost innumerable forms met with in the vegetable kingdom is, beyond comparison, superior to all that went before it; and though the classes, in which the orders are grouped, be somewhat arbitrary, they are yet so convenient, and generally so easily distinguishable in practice, as to leave little room to doubt that the arrangement, as a whole, owes much of its celebrity, and its recent almost universal adoption, to that very blemish. Various attempts have, however, been made to remove that imperfection from this justly admired system, but, so far as I am able to judge, all only serve to show, that, had Jussieu adopted any such arrangement, in place of his own, in the first instance, there is much reason to believe the sexual system, with all its imperfections, would still have reigned paramount in Botany.

" ' Jussieu originally prefixed no names to his classes, and the want of this was much objected to. Those which we have given have been lately proposed by Antoine L. de Jussieu in the *Dictionnaire des Sciences Naturelles;* and, although not entirely in unison with the principles of the Greek language, may be adopted as extremely useful, each being so framed as to suggest the structure of the class. Thus the commencement *Mono*, indicates the Monocotyledones. *Epistamineæ*, &c. having in no part any allusion to a corolla, suggests its absence. *Hypocorollæ*, and the others, allude to the corolla being of one piece, and not of distinct petals, which last is pointed out by names, *Epipetalae*, &c. The other parts of the names, *epi* (upon), *peri* (around), and *hypo* (under), need no farther explanation.

" ' While engaged in the study of plants alone, it is obviously of little consequence whether we begin, as Jussieu did, by the Acotyledones, or by the Dicotyledones; but, if we view botany as a science that treats of only one of the great kingdoms of nature, and wish to introduce it into a *Systema Naturæ*, we must bring those portions of each most closely together which are most nearly linked. So that if we commence by Zoology, we must first describe the Mammalia, and end by those of a simple structure; and then take up the most allied of the Acotyledones, and follow the steps of Jussieu. But, if we describe vegetables in the first place, we must begin with the Dicotyledones, and finish with the Acotyledones. When, however, a *Systema vegetabilium* is contemplated without reference to animals, it may perhaps smooth the way to the student if it commence by those more obvious, and, though of more complex formation, yet more simple to be comprehended. On this account DeCandolle has reversed the arrangement of Jussieu.' (Article Botany Encly. Brit. 7th Ed. by Dr. Arnott)."

III.—*Illustrations of the Botany and other Branches of the Natural History of the Himalayan Mountains, and of the Flora of Cashmere.* —*By* J. Forbes Royle, M. D., V. P. R. S., *Late of the Medical Staff of the Bengal Army, &c. &c. &c.*

In former numbers of this Journal we have rendered the deserved meed of praise to previously published parts of this splendid and highly interesting work. It is now concluded, by the publication of the 11th or supplementary number (just received in India); which, besides the termination of the botanical illustrations, forming, of course, the bulk of the work, includes short treatises on the following subjects:—1st. *On the Geology of the Himalayan Mountains,* by Professor Royle;—2d. *On the Meteorology of the Plains* and *Mountains of N. W. India,* by the same;—3d. *On the Entomology of the Himalayas and of India,* by the Rev. F. W. Hope, F. R. S., F. L. S., &c., President of the Entomological Society of London;—4th. *Memoir on the Mammalogy of the Himalayas,* by Wm. Ogilby Esq. M. A. &c. &c., Secretary to the Zoological Society of London;—5th. *List of Birds in Dr. Royle's Collection.* The two first of these we have transferred to the pages of our present number, and we are sure we cannot more effectually subserve the cause of Science, than by republishing the whole of these valuable treatises, which will, through the medium of this Journal, penetrate into remote parts of India, where the extremely valuable original work, owing to its bulk and costliness, may never reach.

XV.—*Proceedings of the Madras Literary Society and Auxiliary of the Royal Asiatic Society.*

Thursday Evening, 11th June 1840.—*Colonel* W. MONTEITH, K. L. S. *in the Chair.*

The following works, presented to the Society, were laid on the table, and thanks voted to the donors:—

Choix De Contes et Nouvelles traduits du Chinois par Théodore Pavie—By the Translator.

Calcutta Journal of Natural History, No. 1—By the Editor.

The following communication to the Society, was laid before the meeting:—

Continuation of the Catalogue of the birds of Southern India.—By T. C. Jerdon, Esq.—Tribes *Tenuirostres* and *Fissirostres.*

(Published in our present number.)

Thursday Evening, 2d July 1840.—A. D. CAMPBELL, ESQ. *President of the Committee of Papers, in the Chair.*

The following works, presented to the Society, were laid on the table, and thanks voted to the donors:—

A Guide to Chemical Testing and Analysis.—By LIEUT. BRADDOCK.

Transactions of the Royal Medico-Botanical Society of London, vol. 1, part 4.—By the Medico-Botanical Society.

Journal of the Royal Geographical Society of London, vol. 9, part 3. —By the Royal Geographical Society.

Journal of the Asiatic Society of Bengal, No. 96, December 1839.— By the Asiatic Society.

Read a letter from the Secretary to the Geological Society of London, dated 7th November 1839—expressing the Society's thanks for the donation of the Madras Society's Journal.

Read a letter from the Secretary to the London Linnean Society, dated 5th November 1839—returning the Society's thanks for Nos. 13 to 22, both inclusive of the Society's Journal.

Read a letter from the Secretary to the British Museum, dated 13th January 1840—acknowledging the receipt of the Society's Journal, Nos. 22 and 23, and returning thanks for the same.

The following communications to the Society were presented:—

A note by Colonel Cullen on the carboniferous deposits on the Malabar Coast.

(Published with Mr. Newbold's Paper in the present No.)

A specimen of Coal from Mergui on the Tenasserim Coast was presented from the same gentleman, with the following account of the locality whence it was derived.

Extract from a letter addressed to Government, on 9th December 1839.

I have the honour to state, for the information of His Honour in Council, that during the past month, I personally visited the site of the last discovered coal-field, on the banks of the Tenasserim river, and the results of my observations on the spot, are, that there can be no doubt we shall eventually succeed in procuring the present limited quantity of 50,000 maunds of coal, at an expense not exceeding five annas per maund—that a portion only (say 10,000 maunds) of this quantity can be brought down during the present fine season, and that the larger the quantity required to be supplied, the less will be its prime cost in depôt. The coal is found at the distance of about half a mile from the bank of the river. The intermediate space is a level, and as excellent timber abounds in the neighbourhood, there will be no difficulty in constructing a tram-road for the conveyance of the coal to the river. It is a curious circumstance that the spot where the coal was discovered, and has been dug out in small quantities by the natives, appears to be the summit of an upheaving. The spot in question is the bed of a small winding nullah, not exceeding thirty feet in width, and in the winding or small reach where the coal was first discovered, it is found by digging to the depth of a few feet only, across half the width of the nullah, while the other half has none. About the centre of the nullah it commences and appears to dip towards the S. W. (the right side of the nullah at this spot) at an angle of about thirty or thirty-five degrees, while the line of the bed itself, which I may call the line of greatest height, appears to run about N. E. but to what extent is as yet wholly unknown. A section of the right bank of the nullah discovers:

1st.—Soil to the depth of about eighteen feet.

2d.—Slate to the depth of five feet, under which is found the coal, said by those who have dug there (I was unable to test the accuracy of this assertion) to extend to a depth of ten feet, when a layer of mud of three or four feet is found, and, below that again, coal. It appeared to me that the best plan of operations would be to turn the course of the nullah (a work of no difficulty), and to take the old bed of it, at the place hitherto worked, as a kind of shaft, from whence the coal might be followed in its dip; but I have left the plan of operations entirely to Lieut. Hutchinson, from whose peculiar qualifications in work requiring mechanical skill, I feel confident the best result may be anticipated.

It is obvious from the above brief description of the nature of the coal bed, that some considerable preliminary operations are necessary, ere the coal can be worked to any extent, but I imagine there are few localities in any part of the world, presenting similar facilities. When once a clearing has been made of the nature of a shaft, from whence galleries may be carried, following the dip of the coal, and a tram-road formed for conveying it to the river, it is evident that the more coal taken out, the less will be its prime cost in the depôt of Mergui, and the only question is, what is likely to be the expense of the preliminary operations. Assisted as Lieut. Hutchinson will be by gangs of convicts, I feel confident that by the month of March, or April next, he will have every thing in train for putting coal on board the rafts, or barges provided for it, at an expenditure considerably under 8,000 rupees. When all his arrangements are thus complete, it will not matter how large the quantity of coal required may be, as the additional expense involved in procuring large quantities will be insignificant.

Extract from a letter to my address from Lieut. HUTCHINSON, *Superintendent of the Coal Mine.*

The reach of the nullah, in which the formation chiefly shews itself, and where some tons of coal have been dug out by the natives, runs in N. N. E. direction.

Near the south extremity of the eastern bank, the upper stratum of coal shews itself above the bed of the nullah, covered by five feet of clay-slate, six feet of iron clay, and about six feet of gravel, sand, and vegetable soil; dipping at an angle of 30° towards the N. E. There is a dislocation of the strata at this point, the whole formation sinking abruptly, two feet below the nullah bed, upon which level it extends 200 yards towards the north-west; how much farther I cannot at present say. The first stratum of coal in the horizontal bed, lies from fifteen to thirty feet below the surface, and has been ascertained to extend ten feet in the thickness.

I have therefore determined upon sinking a shaft in this place (about fifty yards from the nullah), and, if no unfavourable circumstances occur, commencing to work the mine from this point.

(True extract)
(Signed) E. A. Blundell, *Commissr. in the T. P.*

(True copies)
(Signed) Henry Jas. Nicholls.
S. A. C. G. Tenasserim Provinces.

The thanks of the Society were voted to **Colonel Cullen** for the above communication.

Mr. **Braddock** submitted an account of his analysis of the supposed fossil from Hingolee.

NOTE,

By Walter Elliot, *Esq. on the species of Naja described in the last Number of this Journal.*

Since the notice of the Serpent exhibited at the Meeting of the Society on the 13th January last, I have received the Journal of the Zoological Society for 1838, in which, it appears that at the sitting of the 12th June, Dr. Cantor read the following notice of a new Genus proposed by him, to which the reptile figured in the last No. of the Journal appears to be referrible. It will be observed that Dr. Cantor at first considered the species described by him in the Asiatic Researches, as a Naia.

" The venomous serpent, to which I shall here call attention, is the type of a new genus; which, from its inhabiting hollow trees and frequenting the branches, I propose to call Hamadryas. Its characters induce me to assign it a place between the genera Naja, Laurenti, and Bungarus, Daudin, which two forms it will be found to connect together.

" In consequence of the strong resemblance in the general appearance between the Naja and the Hamadryas, when first my attention became attracted to the latter, I thought I could refer this serpent to that genus; and it was not until I was able to examine a specimen whose poison-fangs were untouched (those of the first specimens I saw having been drawn by the natives who are greatly afraid of this serpent) that I discovered the maxillary teeth behind the poison-fangs.

HAMADRYAS, (Cantor.)

" *Generic Character.*—*Head* broad, subovate, deplanate, with a short obtuse rostrum, covered above with fifteen *scuta*. *Cheeks* tumid. *Eyes* large, prominent, pupil round. *Nostrils* widely opened within the confine of two *scuta*. *Gape* very ample, subundulated. *Poison-fangs* anterior, behind which are the maxillary teeth. *Neck* dilatable. *Body* thick, smooth, imbricated with smooth scales disposed in oblique rows. *Tail* short, covered with *scuta* and *scutella*, its apex acute. (Cantor.)

" Example.—*Hamadryas ophiophagus.* (Cantor.)

" *Description.*—Above olive-green, girt with black sagittal striæ, abdomen glaucous, marbled with black. The Hindustanee name is *Sunkr-Choar.*

" *Locality.*—Bengal.

" The Hamadryas, like the Bungarus, Hydrus, and Hydrophis, has a few maxillary teeth behind the poison-fangs, and thus like the latter connects the venomous serpents with isolated poison-fangs to the harmless, which possess a complete row of maxillary teeth. Of the terrestrial venomous serpents the Bungarus is chiefly characterized by a distribution of the teeth similar to that of the Hamadryas, which, also partaking of the chief characteristic of the genus Naja, viz. that of forming a hood or disc, constitutes an immediate link between the genera Bungarus and Naja.

" Hamadryas ophiophagus differs from the Naja tripudians:

1. By its maxillary teeth.
2. By the strongly developed spines on the os occipitale inferius.
3. By the integuments covering the head.
4. By the integuments covering the abdominal surface of the tail.
5. By its colour.
6. By its size.

" According to the natives the Hamadryas feeds chiefly upon other serpents; in one I dissected I found remains of a good sized Monitor, which fact may account for its arboreal habits, as I have in Bengal, along the banks of the rivers, observed numbers of those large lizards among the branches of trees watching for birds.

" The power of abstaining from food, generally speaking, so characteristic of the serpents, is but in comparatively small degree possessed by this species; the most protracted starvation amounts to a period of about a month, while the Vipera elegans, the Naja tripudians, and the Bungarus annularis, have, without inconvenience, been confined in cages without any food for more than ten months. Two specimens of the Hamadryas in my possession were regularly fed by giving them a serpent, no matter whether venemous or not, every fortnight. As soon as this food is brought near, the serpent begins to hiss loudly, and expanding the hood rises two or three feet, and retaining this attitude as if to take a sure aim, watching the movements of the prey, darts upon it in the same manner as the Naja tripudians does. When the victim is killed by poison, and by degrees swallowed, the act is followed by a lethargic state, lasting for about twelve hours. Such of the other Indian venomous serpents, the habits of which I have had opportunity to study from life, show themselves much inclined to avoid other serpents, however ready they are to attack men or animals, when provoked or driven by hunger; and I am not aware of any other of those serpents being recorded as preying upon its own kind. A short time ago, however, during my sojourn at the Cape of Good Hope, I received from high authority the following fact, which throws a light upon the habits of the Naja of Southern Africa, one of which, when being captured, threw up the body of a Vipera arietans (Vip. Brachyurus, Cuvier) which bore marks of having been submitted to the process of digestion.

"The Hamadryas, like the greater number of Indian serpents, evinces a great partiality to water; with the exception of the tree-serpents (Leptophina, Bell) they all not only drink, but also moisten the tongue, which, as this organ is not situated immediately in the cavity of the mouth, become in the serpents two different acts. Specimens of this serpent in my possession changed the skin every third or fourth month, a process which takes place in all the Indian serpents several times during the year. The Hamadryas is very fierce, and is always ready not only to attack but to pursue when opposed; while the Cophias, the Vipera, the Naja, and the Bungarus, merely defend themselves, which done, they always retreat, provided no further provocation is offered. The natives of India assert, that individuals are found upwards of twelve feet in length, a statement probably not exaggerated, as I have myself seen specimens from eight to ten feet in length, and from six to eight inches in circumference. I have often heard it asserted, that 'Cobras' (which name is naturally enough given to every hooded serpent) have been met with of an enormous size, but I strongly doubt their belonging to the genus Naja: among a considerable number which have come under my observation, I never saw any exceeding five to six feet in length, while the common size is about four feet. Some time before I discovered the Hamadryas, I was favoured by

J. W. Grant, Esq. of the Honourable Company's Service, with an interesting description of a gigantic hooded serpent he had observed in the upper provinces, and which, he remarked, was not a Naja. By inspection this gentleman denied the Hamadryas to be identical with the above mentioned.

"The natives describe another hooded serpent, which is said to attain a much larger size than the Hamadryas, and which, to conclude from the vernacular name 'Mony Choar,' is perhaps another nearly allied species.

"The fresh poison of the Hamadryas is a pellucid, tasteless fluid, in consistence like a thin solution of gum arabic in water; it reddens slightly litmus paper, which is also the case with the fresh poison of the Cophias viridis, Vipera elegans, Naja tripudians, Bungarus annularis and Bung. cœruleus; when kept for some time it acts much stronger upon litmus, but after being kept it loses considerably if not entirely its deleterious effects.

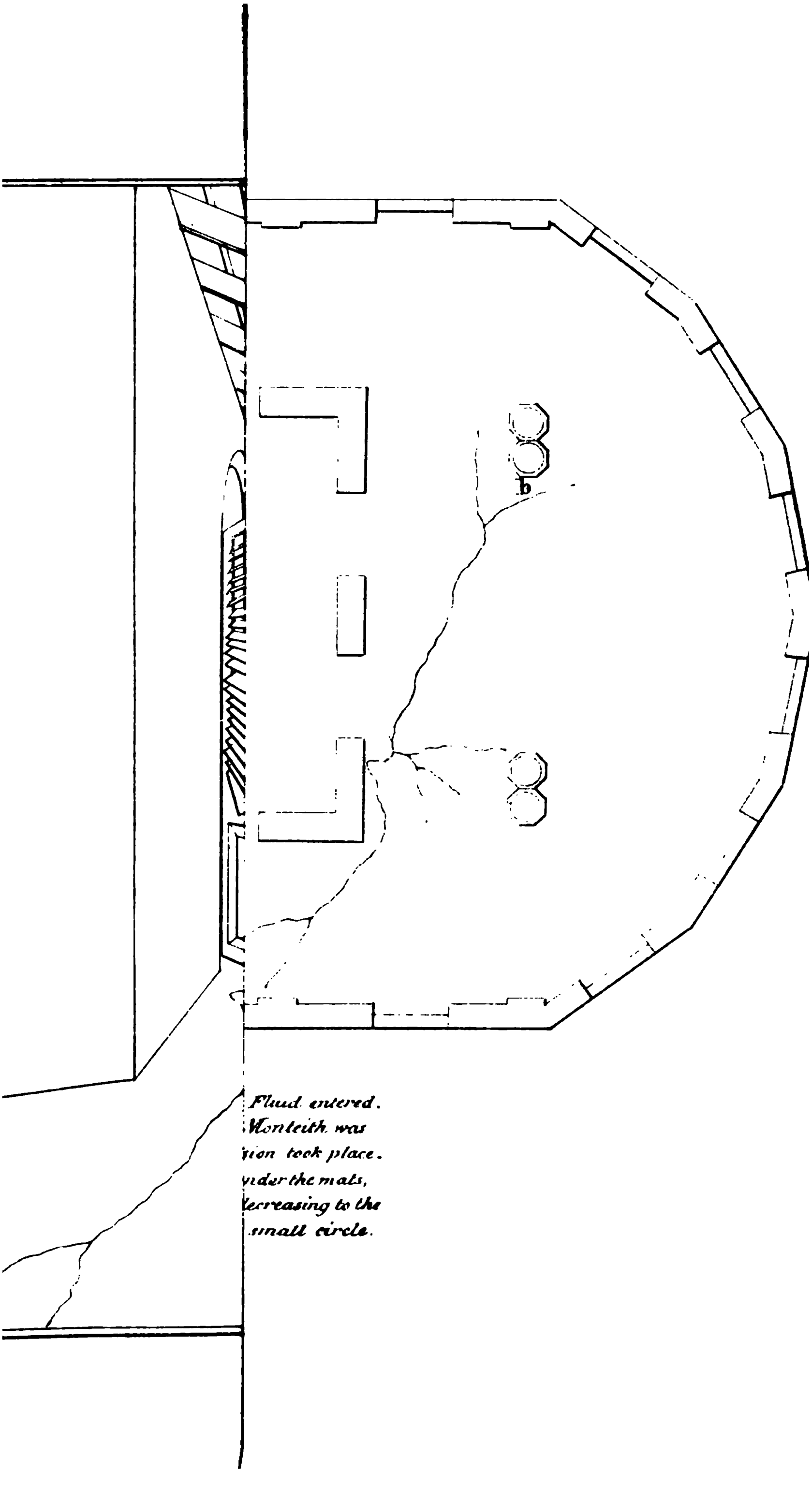
"From a series of experiments upon living animals, the effects of this poison come nearest to those produced by that of the Naja tripudians, although it appears to act less quickly. The shortest period within which this poison proved fatal to a fowl, was fourteen minutes; whilst a dog expired in two hours eighteen minutes after being bitten. It should however be observed, that the experiments were made during the cold season of the year."

XVI.—*Meteorology.*

Account of the progress of the Electric fluid which struck the house belonging to Colonel Monteith, *situated on the Hill at Palaveram, on the* 1*st November,* 1839.—*By* T. G. Taylor, Esq. *H. E. I. C. Astronomer.*

Having been invited to inspect the bungalow belonging to Colonel Monteith upon the hill at Palaveram immediately after it was struck by lightning (on the 1st November last), I have thought that an account and sketch of the progress of the electric fluid, might prove as interesting to others as the inspection did to myself. The hill in question is the lowest of the two which immediately overlook the cantonment of Palaveram, and from a single barometrical measurement, would appear to be elevated 340 feet above the cantonment, and 395 feet above the level of the sea—the other hill being about 110 feet higher: the wind which was strong and came in sudden gusts—as well as the clouds—blew from the N.E., and thunder and lightning were continuous during the evening. "At 10 minutes past 10 P. M." Colonel Monteith states, "a sharp clap of thunder, something like the report of a gun, took place close to the window, and was succeeded at the same moment by a second report *in the room*, which was instantly filled with dust;" this second report Colonel Monteith remarks "I thought at first proceeded from a loaded musket having been fired by the electric fluid"—there was a musket in the adjoining verandah—"at the same time I felt a strong shock over the fore part of the feet, and numbness, extending to the knees, which immediately went off." Colonel Monteith's impression was, that the electric fluid had entered the room through the venetians in the eastern verandah, and passing through the room, had made its exit through the venetians on the western side of the bungalow; but a careful inspection shewed, that it had struck the roof of the bungalow, which is sloping, at about ten feet below the apex, where it broke two or three tiles and proceeded through to the rafters; here refusing the conducting powers of the rafters, it descended nearly perpendicularly through a space of five feet, to a vertical iron bolt, through which it passed quietly, until arriving at the wood work of the door, which it shivered to pieces, and eventually, after passing through the rattan mat, it left a blackened impression of its force upon the chunam. Chunam being a very imperfect conductor of electricity, and hempen twine being a very good one, I should have expected that the twine-lacing of the rattan mats (which covered the whole of the floor of the bungalow), would have been selected by the electric fluid to convey its superabundant excess to the earth, but the case was otherwise; for, although twenty or thirty pieces of twine must have been all but in contact with the electric fluid, still it was evident that not one of these had enacted the part of a conductor.

The first impression on the floor, was exhibited by a dark patch nearly circular, and about an inch in diameter; from hence it separated into three main channels, each of which after pursuing a meandering course, and throwing off two or three branches, eventually stopped short as exhibited in the drawing. I noticed as curious in the terminations of these streams, that four out of the seven exhibited at their termination a circular spot, somewhat larger than the diameter of the stream itself; two others were dissipated without any mark, and that which passed under Colonel Monteith's feet (apparently the weakest of the whole) terminated in a broad splash.



Fluid entered.
Monteith was
tion took place.
nder the mats,
ecreasing to the
small circle.

2d.—*At the Trevandrum Observatory at the Vernal Equinox* 1840.

Date.	Hour.	Newman's Standard bar. corrected for temp. 32° and for capillarity.	Standard thermometer.	Depress. of wet bulb. thermometer.	Dew point.	Direction of wind.	Velocity of the wind.	Solar radiation.	Clouds, aspect of the sky and remarks.
Mar. 21	6 A.M.	29.699	76.0	2.9	71.82		„		Cumuli about the hor.—rest clear [calm.
	7	.728	76.5	2.9	72.34	N. E.	1	2.5	Do. do. wind just perceptible
	8	.745	81.0	5.4	73.38	do.	2	7.0	Do. do. do.
	9	.757	84.0	6.4	75.12	do.	„	5.3	Do. do. calm.
	10	.755	87.2	11.2	71.25	S. W	1	cly.	Cloudy light air.
	11	.743	88.8	10.9	73.55	do.	6	do.	Do. pleasant wind.
	Noon.	.703	89.3	11.5	73.25	do.	6	12.0	Zenith getting clear do.
	1 P.M.	.684	90.0	12.7	72.12	do.	6	13.0	Sky clear do.
	2	.647	90.0	13.1	71.46	do.	7	9.0	Do. do.
	3	.626	89.2	12.1	72.15	do.	7	8.5	Sky pretty clear do.
	4	.625	88.7	11.4	72.69	do.	5	3.0	Do. gentle wind.
	5	.635	86.7	10.9	71.12	SS. W.	4	2.0	Do. do.
	6	.643	84.7	9.6	70.94	do.	4		Do. do.
	7	.667	83.8	9.4	70.22	do.	2		Do. light air.
	8	.701	83.7	8.9	70.92	do.	„	No observation.	Thick cumuli nearly calm.
	9	.715	83.4	7.3	73.12	do.	„		Clearing do.
	10	.716	81.6	6.8	71.89	do.	„		Sky clear do.
	11	.716	80.3	5.8	72.10	N.	1		Do. light air.
	Mid.	.691	78.7	4.9	71.65	NN. E.	2		Do. do.
„ 22	1 A.M.	.681	78.4	4.8	71.48	N.	1		Sky getting cloudy do.
	2	.674	77.6	4.3	71.39	do.	„		Do. calm.
	3	.675	76.6	3.5	71.54	do.	„		Do. do.
	4	.680	75.7	2.8	71.65	do.	„		Sky pretty clear do.
	5	.689	75.5	3.4	70.52	do.	„		Do. do.
	6	.702	75.0	3.2	70.30	do.	„		Sky very clear do.
	7	.722	76.8	4.0	70.99	N. E.	1	0.5	Do. light air.
	8	.761	82.6	6.7	73.15	do.	2	3.0	Do. do.
	9	.778	85.6	9.3	72.46	do.	3	8.0	Do. gentle wind.
	10	.765	88.0	12.1	70.71	do.	3	8.5	Do. do.
	11	.737	90.6	14.0	70.67	do.	4	8.5	Do. do.
	Noon.	.695	91.7	15.8	68.89	SW. by W	6	14.0	Do. pleasant wind.
	1 P.M.	.667	91.7	15.1	70.14	do.	8	12.5	Do. brisk gale.
	2	.637	91.6	14.2	71.56	W.	10	7.0	Do. do.
	3	.628	91.0	14.2	70.82	SW. by W	6	6.0	Do. pleasant wind.
	4	.616	90.2	13.9	70.34	do.	6	2.5	Do. do.
	5	.625	88.4	10.2	73.29	do.	2	clo.	Cloudy wind just perceptible.
	6	.645	86.9	9.2	73.72	do.	2	do.	Do. do.

No Rain.

The Instruments are the same, and situated exactly as before.

G. Sperschneider, *Superintendent.*

At the Trevandrum Observatory at the Summer Solstice 1840.

Date.	Hour.	Newman's Standard bar. corrected for temp. 32° and for capillarity.	Standard thermometer.	Depress. of wet bulb. thermometer.	Dew point.	Direction of wind.	Velocity of the wind.	Solar radiation.	Clouds, aspect of the sky and remarks.
June 21	6 A.M.	29.686	78.6	2.1	75.69				Zenith clear—rest cloudy calm.
	7	.701	80.1	2.0	77.33	W.	1		Cloudy wind hardly perceptible.
	8	.720	82.3	3.9	76.91	WN. W.	2	0.5	Light clouds wind just do.
	9	.736	83.4	5.5	75.79	W.	2	1.9	Do. do. do.
	10	.740	84.8	6.4	75.94	do.	3	7.3	Do. cumuli about horizon—gentle wind.
	11	.726	85.4	6.6	76.27	do.	3	7.8	Do. do. do.
	Noon.	.713	85.7	7.2	75.73	do.	4	6.1	Zenith clear do. do.
	1 P.M.	.695	86.8	8.2	75.44	WN. W.	5	4.6	Do. do. do.
	2	.668	86.6	8.3	75.09	do.	8	9.3	Do. do. pleasant wind.
	3	.659	86.0	7.5	75.61	do.	5	drz.	Drizzling do.
	4	.651	86.0	7.4	75.76	N. W.	5	3.0	Sky obscured with thick clouds do.
	5	.660	85.0	6.9	75.44	do.	3	0.5	Sky getting cloudy gentle wind.
	6	.671	84.0	6.4	75.12	do.	4		Overcast—at 6h. 30m. drizzling do.
	7	.679	81.5	4.4	75.39	do.	5	No observation.	Clear do.
	8	.705	80.9	3.7	75.78	NW by W	5		Zenith clear—cumuli about hor. do.
	9	.723	80.6	3.3	76.04	do.	2		Clear light air.
	10	.744	80.2	3.1	75.91	do.	4		Do. gentle wind.
	11	.734	79.8	2.7	76.13	do.	4		Do. do.
	Mid.	.726	79.6	2.5	76.14	do.	4		Sky getting cloudy—at 12h. 20m. drizzling do.
„ 22	1 A.M.	.710	79.8	2.2	76.76	W.	2		Do. light air.
	2	.691	79.5	2.2	76.46	do.	3		Sky pretty clear gentle wind.
	3	.680	78.5	2.8	74.58	do.	3		Threatening—at 2h. 20m. rain do.
	4	.672	78.4	1.9	75.77	do.	4		Zenith clear—rest cloudy do.
	5	.671	78.5	1.9	75.87	N W. by W	3		Do. do. do.
	6	.684	78.6	1.8	76.11	do.	2		Do. do. moderate breeze
	7	.703	80.2	2.4	76.88	N. W.	2	1.5	Very clear do.
	8	.708	82.1	3.8	76.84	do.	4	3.0	Cloudy—at 7h. 50m. drizz.—pl. wind.
	9	.699	83.6	5.7	75.71	WN. W.	3	6.1	Flying clouds gentle wind.
	10	.696	84.7	6.4	75.84	W.	2	5.3	Sky rather clear wind just perceptible.
	11	.678	85.3	6.2	76.73	WN. W.	4	4.8	Clear gentle wind.
	Noon.	.665	86.2	6.9	76.67	do.	6	4.3	Do. pleasant wind.
	1 P.M.	.647	87.0	7.9	76.08	N. W.	5	2.5	Zenith clear—cumuli about hor. do.
	2	.615	87.0	8.9	74.63	do.	3	3.5	Do. do. do.
	3	.598	86.5	8.4	74.84	do.	5	2.0	Sky getting cloudy do.
	4	.591	86.0	7.9	75.04	do.	6	1.4	Do. pleasant brisk gale.
	5	.599	85.0	7.0	75.30	WN. W.	7	0.3	Do. do.
	6	.611	83.5	5.9	75.32	do.	4		Do. gentle wind.

June 21st rain fell from 6 A. M. to 6 P. M. None.
do. 6 P. M. to 6 A. M. ·0421
June 22d do. 6 A. M. to 6 P. M. None.

Total. ·0421

The Instruments are the same, and situated exactly as before.

G. Sperschneider, *Superintendent.*

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY; FOR THE MONTH OF JANUARY, 1840.

Days.	Barometer at			Ther. at			Wet Bulb.			Rain.		Evaporation.	Strength of wind.	Direction of Wind.			Cloudy Max.	Weather.		Remarks.	
	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	Sun-rise.	Sun-set.			10 A. M.	4 P. M.	10 P. M.		10 A. M.	4 P. M.	10 P. M.	
1840	Inch.	Inch.	Inch.	o	o	o	o	o	o			Inch.									
Jan. 1												2,096	—								
2	30,194	30,092	30,153	80,3	82,0	79,3	—	7,0	6,9	......	......	......	2,3	N E	E. S E	E	2	Fly. cl.	Clear	Clear	dew.
3	,200	,104	,200	80,3	80,0	78,5	6,8	7,7	6,0	......	......	......	2,3	N E	N E	N E	2	Fly. cl.	Clear	Clear	do.
4	,224	,119	,164	80,5	82,5	79,5	6,0	8,0	6,5	......	......	......	2,3	E	N. N E	N	2	Clear	Fl. cl.	Clear	do.
5	,174	—	,162	78,8	—	78,3	4,8	—	5,0	......	......	......	2,3	N E	—	N E	2	Fly. cl.	—	Clear	do.
6	,188	,102	,200	80,5	82,4	78,6	6,9	8,9	6,5	......	......	......	3	N E	N E	E	2	Clear	Fl. cl.	Flying clouds	do.
7	,234	,130	,216	79,6	81,0	77,2	6,6	11,5	9,7	......	......	......	3	N E	N. N E	N E	2	Fly. cl.	Fly. cl.	Clear	do.
8	,220	,112	,198	77,1	82,0	76,8	11,1	—	10,3	......	......	2,818	3	N E	N E	N	2	Fly. cl.	Fly. cl.	Flying clouds	do.
9	,200	,094	,168	76,5	79,8	76,3	11,5	13,8	10,3	......	......	......	2,3	N E	E. N E	N	4	Fly. cl.	Fly. cl.	Flying clouds	—
10	,218	,125	,184	78,0	78,8	79,0	12,5	10,8	9,7	......	......	......	2,3	N E	N EbyN	N	5	Cloudy	Cloudy	Cloudy	—
11	,200	,090	,176	78,3	78,6	77,6	9,0	9,6	8,6	......	......	......	2,3	N E	E by N	N E	4	Clear	Fl. cl.	Flying clouds	dew.
12	,182	,100	,170	78,6	80,8	78,0	8,6	8,2	—	......	......	......	2,3	N E	N E	—	3	Fly. cl.	Fly. cl.	Flying clouds	do.
13	,216	,125	,192	78,2	78,0	79,2	10,0	10,3	9,8	......	......	......	2,3	N E	N. N E	N E	2	Fly. cl.	Fly. cl.	Brisk breeze	do.
14	,268	,138	,222	78,4	79,2	77,8	9,9	9,2	9,4	......	......	......	2,3	N E	E. N E	NE.byE	2	Clear	Fly. cl.	Clear	do.
15	,232	,102	,182	77,8	77,8	79,2	9,0	10,2	—	......	......	3,298	3	N E	N E	N E	2	Fly. cl.	Fly. cl.	Flying clouds	do.
16	,172	,052	,146	76,5	79,1	75,7	9,3	10,6	8,6	......	......	......	2,3	E	N E	N E	4	Ely. cl.	Fly. cl.	Flying clouds	do
17	,174	,078	,152	76,8	79,0	74,3	9,7	12,2	6,8	......	......	......	2,3	N E	N E	N	4	Clear	Fly. cl.	Flying clouds	—
18	,200	,106	,184	77,7	79,6	72,8	10,7	8,4	5,6	......	......	......	2,3	N E	N E	N	3	Fly. cl.	Fly. cl.	Clear	dew.
19	,208	—	,186	76,8	—	73,1	5,3	—	6,0	......	......	......	2,3	N E	—	N	3	Clear	—	Clear	do.
20	,230	30,122	,200	77,3	79,5	74,2	6,7	7,7	4,1	......	......	......	2,3	N E	NE byN	N	2	Fly. cl.	Clear	Clear	do.
21	,238	,110	,182	77,0	79,4	74,4	3,8	4,8	3,6	......	......	......	2,3	N	N E	N	2	Fly. cl.	Clear	Clear	do.
22	,170	,075	,152	76,4	79,5	74,2	1,9	8,2	5,1	......	......	2,859	2,3	N E	N E	N	2	Fly. cl.	Clear	Flying clouds	do.
23	,176	,078	,154	77,0	79,3	76,2	7,4	7,5	3,7	......	......	......	2,3	E	N E	N	3	Clear	Fl. cl.	Flying clouds	do.
24	,158	,038	,088	76,9	79,8	74,3	6,9	6,0	4,3	......	......	......	2	N W	E	S	3	Clear	Clear	Clear	do.
25	,102	,010	,072	76,3	80,0	74,4	4,3	7,0	3,6	......	......	......	2	E	E	E	2	Fly. cl.	Clear	Clear	do.
26	,100	—	,116	76,5	—	73,9	4,5	—	—	......	......	......	2	S E	—	N E	3	Fly. cl.	—	Flying clouds	do.
27	,160	30,040	,130	77,9	80,0	78,3	7,1	8,3	8,3	......	......	......	2	S E	E	E	2	Fly. cl.	Fly. cl.	Clear	do.
28	,128	,022	,112	78,0	80,2	77,8	6,5	6,4	7,0	......	......	......	2	S E	E	E	2	Fly. cl.	Clear	Clear	do.
29	,154	,020	,104	78,0	80,0	75,3	6,5	8,0	6,4	......	......	2,860	2	S E	S E	E	1	Fly. cl.	Clear	Clear	do.
30	,142	,006	,088	76,8	80,1	75,9	6,2	5,1	8,1	......	......	......	2	S	S E	S E	1	Fly. cl.	Clear	Clear	do.
31	,135	—	,060	77,3	—	77,8	4,8	—	3,6	......	......	......	2	S	—	S E	2	Clear	—	Clear	do.
Mean	30,187	30,084	30.157	77,9	79,9	76,6	7,4	8,6	6,8												

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY; FOR THE MONTH OF FEBRUARY, 1840.

Days.	Barometer at			Ther. at			Wet Bulb.			Rain.		Evaporation.	Strength of wind.	Direction of wind.			Cloudy Max.	Weather.			Remarks.
	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	Sun-rise.	Sun-set.			10 A. M.	4 P. M.	10 P. M.		10 A. M.	4 P. M.	10 P. M.	
1840	Inch·	Inch.	Inch.	o	o	o	o	o	o												
Feb. 1	30,120	——	30,108	77,8	—	76,3	5,3	—	6,1	......	......	......	2	S E	——	S E	1	Fl. cl.	——	Clear	dew.
2	30,146	——	30,132	76,3	—	76,3	6,3	—	5,4	......	......	......	2	N E	——	S E	1	Fl. cl.	——	Clear	do.
3	30,168	30,040	30,106	77,9	80,0	74,9	7,3	8,3	5,0	......	......	......	2	E	——	S E	1	Fl. cl.	——	Clear	do.
4	,156	,040	,106	76,9	80,4	76,6	5,2	7,9	5,6	......	......	......	2	E.	E	E	2	Fl. cl.	Clear	Flying clouds	do.
5	,150	,040	,132	78,3	80,3	74,9	5,7	8,8	5,9	......	......	2,301	2	S E	E	N E	1	Fl. cl.	Fl. cl.	Clear	do.
6	,148	,020	,066	77,5	80,6	74,3	6,6	8,1	5,4	......	......	......	2	E	E	N E	1	Fl. cl.	Clear	Clear	do.
7	,094	29,982	,058	76,5	80,6	77,3	5,5	5,9	6,5	......	......	......	2	S W	S E	E	1	Fl. cl.	Clear	Clear	do.
8	,104	30,028	,128	77,7	80,0	78,1	6,1	6,5	5,1	......	......	......	2	E	S E	E	2	Fl. cl.	Haze	Flying clouds	do.
9	,154	——	,130	79,0	—	79,2	4,5	—	5,2	......	......	......	2	E. NE	——	S E	3	Fl. cl.	——	Flying clouds	do.
10	,160	30,050	,108	79,6	80,7	74,8	7,0	6,2	3,9	......	......	......	2	E	E. S E	S E	1	Fl. cl.	Clear	Clear	do.
11	,154	,033	,102	79,7	80,7	77,7	7,1	6,2	4,5	......	......	......	2	N E	S E	N E	2,3	Fl. cl.	Fl. cl.	Flying clouds	do.
12	,126	,013	,086	79,2	80,5	78,7	6,0	6,7	4,5	......	......	2,240	2	N E	E	N E	2	Fl. cl.	Fl. cl.	Clear	do.
13	,114	29,990	,060	79,8	80,8	79,6	6,2	6,1	3,8	......	......	......	2	S E	S E	N E	3	Clear	Clear	Flying clouds	do.
14	,100	29,983	,050	79,9	81,0	79,4	5,9	6,0	4,6	......	......	......	2	S E	S E	——	2	Fl. cl.	Clear	Clear	do.
15	,100	29,986	,060	79,2	81,4	78,4	5,2	6,4	2,7	......	......	......	2	S W	S E	E	1	Clear	Clear	Quite clear	do.
16	,102	——	,088	80,0	—	75,7	7,0	—	3,4	......	......	......	2	S E	——	E	1	Clear	——	Clear	do.
17	,144	——	,078	78,3	—	77,9	6,7	—	4,7	......	......	......	2	N W	——	E	1	Clear	——	Clear	do.
18	,116	30,016	,100	78,1	81,3	74,5	4,4	6,3	2,7	......	......	......	2	N W	S E	N W	0	Clear	Clear	Clear	do.
19	,144	,025	,082	78,6	82,0	76,3	6,8	8,5	1,3	......	......	2,308	2	S W	SE. by S	S E	0	Clear	Clear	Clear	do.
20	,116	,017	,084	78,7	86,0	78,0	10,8	18,0	5,6	......	......	......	2	S ½ W	S E	S	0	Clear	Clear	Clear	do.
21	,108	29,982	,070	79,7	86,8	77,9	15,0	15,3	6,2	......	......	......	2	S ½ W	S	W	0	Clear	Clear	Clear	do.
22	,116	30,018	,100	80,3	85,0	76,3	5,8	10,0	5,0	......	......	......	2	S	S	E	0	Clear	Clear	Clear	do.
23	,162	——	,082	79,8	—	79,0	3,3	—	5,1	......	......	......	2	S E	——	N E	2	Clear	——	Flying clouds	do.
24	,214	30,108	,168	80,2	82,8	77,0	5,6	7,6	2,6	......	......	......	2	E	E by S	N W	1	Fl. cl.	Clear	Clear	do.
25	,204	,100	,180	79,7	83,0	77,4	5,2	8,0	3,4	......	......	......	2	S E	E	N E	1	Clear	Clear	Clear	do.
26	——	,062	,140	—	84,3	76,4	—	9,1	3,9	......	......	2,561	2	——	S E	E	2	——	Clear	Clear	do.
27	30,158	,050	,140	82,0	82,4	78,2	7,0	6,6	5,2	......	......	......	2	S W	S. S E	E	2	Clear	Clear	Clear	do.
28	30,156	,028	,098	79,9	85,2	80,3	4,9	10,7	1,8	......	......	......	2	S E	S. S E	S	1	Clear	Clear	Clear	do.
29	,136	,023	,098	80,3	84,0	80,3	5,4	7,5	4,3	......	......	......	2	S E	S	S	1	Clear	Clear	Clear	do.
Mean	30,138	30,027	30,101	79,0	82,2	77,3	63	8,3	4,5												

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY; FOR THE MONTH OF MARCH, 1840.

Days.	Barometer at 10 A. M.	Barometer at 4 P. M.	Barometer at 10 P. M.	Ther. at 10 A. M.	Ther. at 4 P. M.	Ther. at 10 P. M.	Wet Bulb. 10 A. M.	Wet Bulb. 4 P. M.	Wet Bulb. 10 P. M.	Rain. Sun-rise.	Rain. Sun-set.	Evaporation.	Strength of wind.	Direction of Wind. 10 A. M.	Direction of Wind. 4 P. M.	Direction of Wind. 10 P. M.	Cloudy Max.	Weather. 10 A. M.	Weather. 4 P. M.	Weather. 10 P. M.	Remarks.
1840	Inch.	Inch.	Inch.	o	o	o	o	o	o												
Mar. 1	30,134	——	30,124	80,0	——	79,8	6,5	—	5,0	.....	.....	......	2	S W	——	S	0	Clear	Clear	Clear	dew.
2	,164	30,058	,140	79,5	83,4	79,8	6,5	9,6	8,8	.....	.....	......	2	S E	S E	S	0	Clear	Clear	Clear	do.
3	,158	,068	,148	79,8	82,0	76,3	8,3	9,4	6,5	.....	.....	......	2	E	S E	W	0	Clear	Clear	Clear	do.
4	,180	,060	,132	76,0	82,3	77,2	4,3	8,8	6,7	.....	.....	2,491	2	S W	S E	E	1	Clear	——	Clear	do.
5	,164	,040	,112	78,6	82,6	76,9	5,9	10,3	7,3	.....	.....	......	2	S W	S E	E	0	Clear	Clear	Clear	do.
6	,156	,034	,128	78,6	83,5	79,7	6,6	9,0	6,8	.....	.....	......	2	S W	S E	S	0	Clear	Clear	Clear	do.
7	,160	,055	,124	80,0	83,0	77,8	6,0	8,0	3,2	.....	.....	......	2	S E	S E	S	2	Clear	Clear	Clear	do.
8	,154	——	,098	79,9	—	79,3	6,6	—	8,7	.....	.....	......	2	S E	——	S E	0	Clear	——	Clear	do.
9	,142	——	,092	80,3	—	80,2	8,2	—	6,5	.....	.....	......	2	S	——	S E	2	Clear	——	Clear	do.
10	,136	30,023	,116	80,6	84,0	78,6	6,1	9,0	5,6	.....	.....	......	2	S E	S E	S E	0	Clear	Clear	Clear	do.
11	,108	,020	,050	80,8	84,2	80,8	5,9	9,7	4,4	.....	.....	2,638	2	S	S E	E S E	1	Fl. cl.	Clear	Clear	do.
12	,112	29,988	,056	81,5	84,0	78,8	6,5	7,0	3,8	.....	.....	......	2	S	S E	S	0	Clear	Clear	Clear	do.
13	,102	,986	,078	81,8	83,8	80,3	4,4	5,8	4,3	.....	.....	......	2	S	SE. by S	S E	1	Clear	Th. hz.	Clear	do.
14	,104	,990	,050	80,5	83,8	80,8	4,8	7,3	3,4	.....	.....	......	2	S	S E	S E	0	Clear	Clear	Haze	do.
15	,070	——	29,088	82,4	—	81,4	7,4	—	5,9	.....	.....	......	2	S	——	S E	0	Clear	——	Clear	do.
16	,030	29,978	30,004	82,1	84,8	81,9	5,7	6,8	3,0	.....	.....	......	2	SW. W	S E	S E	1	Clear	Clear	Clear	do.
17	,068	,960	,062	82,3	86,0	81,8	5,1	7,0	3,8	.....	.....	......	2	S W	SE. bys	SE. bys	2	Fl. cl.	Clear	Flying clouds	do.
18	,094	,970	,062	82,0	84,0	81,5	5,8	6,5	5,0	.....	.....	2,421	2	S W	S E	S E	1	Clear	Clear	Clear	do.
19	,100	,968	,046	82,3	83,7	80,4	7,3	7,7	4,4	.....	.....	......	2	S	S	S E	1	Clear	Clear	Clear	do.
20	,090	,960	,058	83,8	84,4	81,5	7,3	5,6	4,0	.....	.....	......	2	S E	S E	S E	0	Clear	Clear	Clear	do.
21	,102	,960	,022	85,9	84,6	80,0	8,9	7,1	2,2	.....	.....	......	2.3	S	S E	S E	1	Clear	Clear	Clear	do.
22	,096	,970	,042	86,3	86,0	81,8	9,8	8,0	3,5	.....	.....	......	2.3	S	S E	S E	0	Fl. cl.	Clear	Clear	do.
23	,102	,968	,040	82,8	86,0	81,8	5,8	8,0	4,3	.....	.....	......	2.3	S	S	S	1	Fl. cl.	Clear	Clear	and along-shore wind.
24	,080	,940	,020	83,9	86,0	82,5	6,4	6,0	4,0	.....	.....	......	2.3	S W	S	S E	1	Fl. cl.	Clear	Clear	distant lightning NW.
25	,054	,973	,050	84,0	86,0	83,5	6,0	6,0	4,0	.....	.....	2,716	2·3	S E	S E	S	1	Fl. cl.	Clear	Clear	distant lightning NW.
26	,058	,960	,040	84,4	86,0	83,8	5,9	5,2	5,3	.....	.....	......	2.3	S E	S	S E	2	Fl. cl.	Clear	Fl. clouds	lightning to the SW.
27	,016	,916	29,988	83,0	85,8	83,0	4,7	6,8	5,0	.....	.....	......	2.3	E	S E	S	1	Clear	Clear	Clear	lightning to the W.
28	,005	,906	,996	86,4	86,4	83,9	7,4	6,9	3,4	.....	.....	......	2.3	S	S E	S	2	Clear	Clear	Clear	lightning to the W.
29	,020	——	30,030	86,0	—	83,7	7,5	—	5,7	.....	.....	......	2.3	S W	——	S	2	Clear	——	Clear	lightning dew.
30	,052	,980	,060	84,3	84,8	82,3	4,3	7,3	4,3	.....	.....	......	2.3	S E	S E	S	2	Clear	Clear	Clear	lightning do.
31	,096	,974	,062	83,4	85,8	82,5	5,4	8,8	4,5	.....	.....	......	2.3	S E	S E	S E	2	Clear	Clear	Clear	lightning do.
Mean	30,100	29,989	30,065	82,0	84,5	80,8	6,4	7,6	4,9												

The Instruments with which the foregoing observations are made, are placed in the Western Verandah of the Honourable Company's Observatory; at about five feet above the surface of the ground, and twenty-seven feet above the level of the Sea; the thermometer was made on purpose for the Observatory, and at 75° (the only point at which a comparison has been made) it was found to differ insensibly from the Royal Society's Standard; the barometer is one of two Standards which have been lately constructed, and may be depended upon to 0,0100 an inch.

J. Crisp, Major.
H. C. Acting Astronomer.

THE

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PUBLISHED UNDER THE AUSPICES

OF THE

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ORD. III.—RASORES, Ill. Swains.—*Game Birds* and *Pigeons.*

FAMILY PAVONIDÆ.

GENUS PAVO, L.—*Peacock.*

265.—*P. cristatus*, L.—*Mohr*, H. and Mah.—*Common Peafowl.*

The *Peafowl* abounds in most of the wooded districts of India, and also in woody nullahs, and low jungle in various parts of the country. It breeds most usually towards the end of the monsoon.

GENUS GALLUS, Briss.

266.—*G. Sonneratii*, Temm.—*Junglee Moorgh*, H.—*Common Jungle Fowl.*

This *Jungle Fowl* is tolerably abundant in most of the lofty jungles of the South of India, and is also found in the lower jungle in the Carnatic and eastern range of ghauts. It is not, however, met with in the Northern Circars. It is very partial to bamboo jungle. I once found the eggs of this fowl, seven in number, on the ground in dense jungle at the foot of the Neilgherries. They were of a light pinkish cream colour.

267.—*G. Bankiva*, Temm.—*Red Jungle Fowl.*

This species, hardly distinguishable in appearance from many of the domestic varieties, and unquestionably the origin of most of the varieties of our common fowls, is the only jungle fowl found in the woods of the eastern ghauts in the Northern Division, and is very abundant in some parts, as in Goomsoor. I do not know exactly how far south this species extends, but know that it is found as low as Cummum, N. L. 16°. The crow of this bird is much more distinct and marked than that of the last one, which has only a broken and very indistinct call.

FAMILY TETRAONIDÆ.

GENUS ORTYGIS, Ill. Swains.—*Hemipodius*, Temm.—*Three-toed Quail.*

268.—*O. pugnax.*—*Hemip. pugnax.*, Temm. P. C. 60-2.—*Tetrao nigricollis* and *Madagascariensis* of the older authors?—*Gooloo*, H. in the South of India.—*Toorah* of others.—*Black throated three-toed Quail.*

This pretty species is tolerably common in most of the well cultivated parts of India, frequenting low jungle, and also fields of pulse, chillee, &c. It is sometimes found solitary, often in pairs, but also in bevies of 5, 6 or 7. It feeds on various grains and seeds, also much upon insects, especially white ants, and the larvæ of grasshoppers, &c.

Colonel Sykes and M. Temminck assert the identity of the plumage of both sexes, and though I did not examine them when I shot several in company, they were always clothed alike.

This bird is often caught and caged by the Mussulmauns of Southern India. It has a peculiarly loud purring call, and this is made use of to ensnare others in the following manner. The female is taken into the jungle in a small cage, chiefly during the breeding season, which is said to be (in the Carnatic) about the end of the monsoon. The cage has a small plank in front of the bars, over which an arched cover is made to fall by the snapping of some thread, placed between the bars. It is then placed on the ground in a low bush and partially concealed by leaves, &c. The bird within begins its loud purring, and any of its kind in the neighbourhood run rapidly to the spot, and commence pecking at the bars of the cage—this soon breaks the thread, and the spring cover falls, ringing a small bell at the same time, by which the owner, who remains concealed, is warned of a capture—15 or 20 are occasionally caught in this way in a single day.

Irides light yellow; bill and legs dull bluish. Length 6½ inches; wing nearly 3½; tarsus $\frac{9}{10}$ths; bill to front ½ inch; weight about 2 oz. 1 dr.

268, *Bis.—O. Taigoor*, Sykes; figured Trans. Zool. Soc. vol. 2.

From the few opportunities I have had of observing this bird, I am inclined to agree with Colonel Sykes, and place it as a distinct species. I have only procured it solitary, in long grass on the more open spaces of the forests of the Western Coast. Bill bluish, with a tinge of yellow beneath. Irides pale yellow. Length 6 to 6¼ inches; wing 3; tarsus fully $\frac{8}{10}$ths; bill rather shorter and less high than in the preceding species.

269.—*O. Dussumierii.—Hemip. Dussumierii*, Temm. P. C.—*Toorah*, H.—*Smallest three-toed Quail.—Button Quail* of some Europeans.

This very small bird, probably one of the least of the order, is always found solitary, generally in long grass, sometimes in the fields of pulse. It is flushed with difficulty, and, as Colonel Sykes remarks, its flight is abrupt and short. Irides pale yellow; bill dusky; legs whitish flesh-coloured. Length 5½ inches; wing nearly 3; tarsus $\frac{7}{10}$ths; bill front $\frac{4}{10}$ths.

GEN. TETRAO.

SUB-GEN. PTEROCLES, Temm.—*Rock*, or *Whistling Grouse.*

270.—*P. exustus*, Temm. P. C.—354 and 360.—*Bur-Teetur*, H.—*Common Whistling Grouse.—Rock Pigeon* of Europeans.

This is a very common and abundant bird in most parts of the open country. It is not found in wooded districts. It associates in parties varying in number from 4 or 5 to 50, or even more, and frequents the open stony plains, and bare fields. It flies swiftly, and generally at a considerable height, and as Colonel Sykes has remarked " has a most peculiar and piercing cry which often announces its approach ere it is observed." It feeds chiefly on a very hard kind of seed. When approached it often squats close, and it is very difficult to distinguish it in some pieces of ground. After its morning meal it always goes to some neighbouring water to drink. Its flesh, which is brown and white, is remarkably hard and tough, and will keep longer than that of any other game bird; this hardness causes it to be less appreciated than it deserves to be, for, when kept a sufficient time and well dressed, it has an excellent flavour, inferior to very few of the Indian game birds.

I have found its eggs several times lately in the months of January and February, placed on the ground without any nest, 3 in number and of light olive greenish hue, speckled with olive brown and dusky, of a very long shape, and equally rounded at both ends.

Length about 13 or 14 inches; wing 7; tail (centre feather) 5; weight of male about 9 oz.; bill, legs, and naked skin round eye, cinereous.

271.—*P. quadricinctus*, Temm.—*Tetrao Indicus* of Gmelin.—*Hundeyree*, H.—*Painted Whistling Grouse* or *Rock pigeon.*

This richly plumaged *rock grouse*, is much more rare than the last, and unlike it is neither gregarious nor found in the open plains. It lives in pairs, and frequents bushy plains, and stony and jungly hills. It flies but a short distance, and its cry, which is of the same character as that of its congener, though much less loud, and deeper, is never heard except when the birds are first flushed.

I have lately got the eggs of this species, also, very similar to the other, bu rather smaller, and with the spots fewer and larger.

Irides deep brown; bill red; naked skin round eye, lemon yellow with a green tinge; feet ochre yellow; claws reddish. Length 10 inches; wing 7½; tail 3; weight of cock bird about 7 oz.

GEN. PERDIX.—*Partridge.*

272.—*P. picta*, Jard. and Selby, Ill. Ornith.—*P. Hepburnii*, Gray and Hardw., Ill. Ind. Zool.—*Kala Teetur*, H.—*Painted Partridge.*

The painted *Partridge* is not found in the Carnatic, nor in the Malabar Coast, and I believe not in the more southern portion of the table land. It begins to be met with first in any quantity about N. lat. 15°, in the neighbourhood of Bellary, and becomes more numerous as you advance towards the north. It frequents both low bushy jungle and grain-fields, especially those of wheat, and also long grass by the sides of rivers, water-courses and elsewhere. The cock bird has a most peculiar crowing note, which though not very loud, is yet heard a long way off. It may be heard morning and evening uttering this croak, generally seen to do so whilst perched on a bush. Mr. Elliot says well on this subject—" Its peculiar cry may be expressed by the syllables *Chē kĕ-kérrĕy*, pronounced very gutturally. The poults chirrup like crickets " The *painted Partridge* is not found in coveys, generally single or in pairs. It breeds during the monsoon, lays 6 or 7 eggs of a smoky bluish white colour, of an oval form, much depressed at the thick end. It is not held in very high esteem for the table. Bill blackish; irides brown; legs yellowish red. Length about 12 inches; tarsus $1\frac{7}{15}$ths; weight of male about 11 oz.

SUB GENUS FRANCOLINUS.—*Spurred Partridges.*

273.—*F. Ponticerianus,*—*Perd. Orientalis*, Gray and Hardw., Ill. Ind. Zool.—*Teetur*, H.—*Common Partridge* of India—*Scavenger Partridge* of some.

The common *Partridge* is found in every part of the peninsula, both in bushy ground, and more especially in cultivated lands, fields and gardens, delighting in the hedge rows. It perches freely even during the day. The cock bird has a most peculiarly loud and piercing call. It is often caught and tamed by the natives, and becomes most familiar, following its owner like a dog and uttering its loud call, when whistled or spoken to. It is also much used for fighting, which it does with great courage and spirit. Its flesh is held in no esteem by Europeans. It breeds towards the end of the monsoon, and in the cold weather. An opinion prevails among the natives, that the partridge lives for seven years, and is then changed into a Cobra di capella !

274.—*F. Spadiceus.*—*Perd. Spadiceus*, Lath.—*Spur-fowl* of Europeans in India.

Unlike the last species, the *spur-fowl* is only found in the denser jungles, as well as of the Eastern as of the Western Coast, and generally along with the *Jungle fowl.* It is found in the low brushwood of the lofty forests, and when flushed, as it is with difficulty, frequently perches on the bough of some lofty tree. It is generally found in pairs, and feeds on various seeds and insects. I found the craws of some crammed with insects alone, among which various species of *Cimices* were the most predominant. Its flesh is excellent and of very high flavour. It is found on the top of the Neilgherries in the dense woods there. The female has been well described by Colonel Sykes. The natives generally consider this bird as more allied to the *jungle fowls* than to the partridges, and it is said to run with its tail elevated.

Bill, naked skin round eye, and legs red. Length 14-15 inches; of which the tail is about 5.

Sub-Genus COTURNIX, Briss.—*Quails.*

275.—*C. Dactylisonans.*—*Ghaghus*, H.—*Large grey Quail* or *Deccany Quail.*

The quail of Europe is by no means common in most parts of the peninsula, and certainly appears in greatest abundance during the cold weather, though according to Sykes and others, it remains and breeds here during the monsoon. It is found generally in long grass by the sides of rivers, tanks, and nullahs, or among the grain-fields, and generally in pairs.

Length 7½ to 8 inches. Average weight about 4½ oz.; bill dusky brown; irides light brown; legs flesh-coloured.

276.—*C. Textilis*, Temm.—*Perd. Coromandelica*, Lath.—*P. olivacea*, Buch.—*Batteir*, H.—*Black breasted Quail.*—*Rain quail* of some.

This pretty little species is very common in most of the well cultivated districts of India, frequenting the fields in bevies, and also patches of grass in various situations, and low jungle. It breeds during the monsoon: many natives consider it as the male of the last. Irides reddish brown; bill horny brown.

Length 6—6½ inches; weight about 2½ oz.

277.—*C. argoondah*, Sykes.—*Perd. Cambayensis*, Auct. ?—*Lowah*, H. —*Rock Quail*—*Bush Quail* of some.

The common rock quail is exceedingly abundant in every part of India, frequenting bushy and stony ground, and also the neighbouring grain-fields in considerable bevies. It is much used by the natives for fighting, which it does with great spirit and obstinacy.

Irides reddish brown; bill dusky blackish; legs red. Length 6—6½ inches.

278. *C. pentah*, Sykes—*Perd. rubiginosa*, Valenc.—*Geerzah*, H.—*Forest quail.*

I fully agree with Col. Sykes in separating this species from the last, from my own observations, its different habitat, and the testimony of all the quail fanciers of Southern India, who will at once point out a

Geerzah among a lot of '*Lowahs*'. It is an inhabitant of all the forests of S. India, and also occasionally and more sparingly found in low jungles, and wooded nullahs in the Carnatic and other regions. It is found at all levels, from the neighbourhood of the sea to the summits of the lofty mountains of the Western Ghauts. The *Geerzah*, though also caught and used for fighting, is in less esteem than the *Lowah*. Irides brown; bill dusky; legs reddish yellow. Length 6½—6¾ inches.

279.—*C. erythrorhyncha*, Sykes.—*Koknee Lowah*, H.—*Red-billed Quail.*—*Black quail* of the Neilgherries.

This very handsomely plumaged quail is very abundant on the top of the Neilgherries, frequenting the low brushwood of the woods, and occasionally entering gardens. As it is mentioned by Colonel Sykes and also by Mr. Elliot, in his Catalogue, it is probably to be found in all the more elevated districts of the Western Ghauts.

Bill and legs fine red; irides brown. Length 6½; weight about 2¾ oz.

280.—*C. Chinensis.*—*Perd. Chinensis*, Auct.

There is an accurate description of this species of quail in Mr. Elliot's notes, taken from a single specimen, shot by a gentleman near Belgaum in the Southern Mahratta Country.

FAM. TRUTHIONIDÆ.

GEN. OTIS, L.

281.—*O. nigriceps*, Vigors—Gould Cent. Him. Birds.—*O. Edwardsii*, Gray and Hardw., Ill. Ind. Zool.—*Tokdar*, H.—*Black-headed* or *Indian Bustard.*

This noble bird is found, I believe, over all the peninsula, except perhaps on the wooded regions of the Western Coast, but more numerous in some localities than in others. Wherever there are extensive plains, whether of long grass or cultivated, this bird is most abundant, more especially on the trap formation of the north-west part of the great table land. The *Bustard* is frequently seen alone, occasionally 2, 3 or 4 together, and often flocks of 20 or more are seen feeding in company. Its most favourite food is large locusts and grasshoppers, also the common black and red *mylabris*, various insects of the genus *buprestis*, *scarabæus* and others, caterpillars, centipedes, and even lizards. Mr. Elliot mentions a quail's egg entire having been found in the stomach of one. In default of insect food, it eats various fruit, grains and seeds, especially the fruit of the *Ber* (*Zizyphus Jujuba*). Several small stones are generally found in the stomach, and I once found some large fragments of a brass bangle in one.

The *Bustard* breeds most generally about the end of the monsoon, and subsequent cold weather, the female laying one or two eggs; it, however, varies much in the time of breeding. The egg is of a dark olive colour, with obscure darker blotches. When feeding, it is generally wary and difficult to approach, but during the heat of the day it lies down either in the long grass, or in the shade of some bush, and is then often approached quite close. It usually takes a long flight when once raised, often several miles, and flies with a continued flapping of its wings, never sailing.

The *Bustard* has a loud hoarse call, by some compared to a bark or a bellow, this is rarely heard however, except when the bird is alarmed. It has, however, another cry, as I learn from Mr. Elliot's notes, which is probably the call to its mate. I extract Mr. Elliot's note on the subject. " October 12th, killed a large *cock bustard*. When first seen he was making a curious noise, like a person in pain moaning, which was heard at a considerable distance. I at first thought it proceeded from some one in distress, and rode towards the spot under that impression, until I saw the *bustard*. He was strutting about on some high ground, expanding his tail, ruffling his wings, and distending his neck and throat, making the feathers stand out like a ruff. I frequently afterwards heard the moaning, always at the same season."

The gular pouch of the cock bird can contain three quarts of water and more.

Length of male 4½ feet; wing 30 inch; tail 13; tarsus 8½; bill (front) 3; expansion of wings nearly 8 feet; weighs sometimes 25 or 26-lbs. The female is about a third less and measures about 3½ feet in length.

282.—*O. aurita*, Lath., Jard. and Selby, Ill. Orn.—*O. fulva*, Sykes.—probably also *O. Indica*, Auct.—*Churz*, H.—*Tun-mor*, Mahr.—*Kunnowl*, Can.—*Florikin* and *Black Florikin.*

It is still a disputed point among naturalists and sportsmen whether the *black florikin* be a distinct species from the common one, or not—and the only two writers on Indian Ornithology who have observed the bird in its native haunts, viz. Major Franklin, and Colonel Sykes, have pronounced it to be a distinct species. From the synonymes I have adopted, it will be seen that I consider them identical, and from my own observations I have concluded that the *black florikin* is the cock bird, in its summer or breeding plumage *only*, Colonel Sykes having accurately described its winter dress as being almost identical with that of the female. I may here state that there are two other opinions prevalent in India on this subject. One is that the *black florikin* is the young bird, and that he *changes* to the livery of the female; the other is that he is the adult cock bird, but that he does not change his plumage. The following are the chief reasons I have for considering the *black florikin* as the nuptial plumage of the common or *fulvous florikin.*

1st. All *black florikin* examined by me (and others, I believe,) have been males.

2d. The *black florikin agrees exactly* with the characters of the *male* of the *O. fulva*, as described by Sykes, in size, length of wing, and acumination of the quill feathers—the points of difference from the female.

3d. The time of the first appearance of the black plumage of the *florikin* corresponds with the era preceding the breeding season—and its disappearance also coincides with the termination of the breeding season; and I have seen specimens in all states of progressive change, from the female garb to that of the perfect *black florikin*, and again from this, their nuptial plumage, to the more sober livery of the rest of the year.

4th. No males in the grey or fulvous plumage, in which at least some black feathers were not visible, were ever shot by me during the breeding or summer season, i. e. from June to November.

5th. I may cite the evidence of Lieutenant Foljambes, in a brief paper in the Journal of the Asiatic Society of Bengal, in which he states it as his belief 'that they are the same bird, but that the black one is only met with in Guzrat during the monsoon,' i. e. the breeding season.

Lastly—I may state that several successful sportsmen, to whom I have lately mentioned my opinion on this subject, fully agreed with me, and even the opinion of those who considered the black birds to be young ones, is, I think, to be added to the testimony in favour of the black being the breeding plumage of the male bird.

In the neighbourhood of Jaulnah, where my observations have been chiefly made, I have seen the male bird just commencing to assume the black plumage early in May, and I believe the majority of them have assumed the perfect black plumage by the beginning of August. By the middle of November most of them have, with the exception of a few stray feathers, occasionally re-assumed their more sober grey livery. I am perfectly aware that there are many occasional exceptions to this; dependent, however, I am convinced, chiefly on the well known great irregularity of the time of breeding, so common in hot countries, where the birds are not compelled, as they are in a cold country, to limit their season of breeding to an odd month or two : and also partly on the fact hereafter mentioned of many pairs breeding, especially towards the south of the peninsula, after the great annual immigration in October and November.

The most general time of breeding of the *florikin* about Jaulnah, is the months of August and September. Birds have, however, been flushed from their eggs as late as October. During this season the females are remarkably shy and wary, and flushed with difficulty, and during the whole monsoon, cock birds, either in a state of change, or in the perfect black plumage, are almost the only ones to be met with. I am informed by native sportsmen that the black bird is occasionally seen in company with the hen at this time, or walking round her whilst sitting on her eggs, yet I think it probable that the cock birds withdraw from the society of the hens soon after incubation has commenced.

Though a few couple remain in most parts of the country, for the whole year, and breed, yet the great body of them undoubtedly migrate to the peninsula at the beginning of the cold weather in October, and remain till March or April, when they emigrate for the purpose of breeding. As before mentioned, after their arrival, several couples undoubtedly breed, sometimes as late as December and January, especially in the Carnatic, the Northern Circars, and Mysore. I believe, however, that the great majority of them do not breed after their arrival in the south, and that such as do are probably the ones bred late in the south of the peninsula the previous year, and which were not sufficiently matured to do so along with the others, in the early monsoon season of Upper India. In the Carnatic, as about Trichinopoly, at the commencement of the season in October, a considerable number of those brought in by the native shikarees are black, chiefly, however, in a state of change from the perfect plumage—they leave this district in February.

I am informed that in the Nellore and Guntoor districts, both the most celebrated *florikin* grounds in Southern India, the *florikin* do not arrive in any numbers till November, and black birds are hardly ever met with. This, I may remark, is an additional proof in favour of my opinion. A few couple, most probably, remain even here, in the wilder and more sequestered parts, for I have heard of a *black florikin* being killed in the Tinnevelly district in the month of August. In the Southern Mahratta Country, as I learn from Mr. Elliot's notes, the *florikin* arrive towards the end of September, and remain till April, except a few stray birds in a *state of change* that remain through the *monsoon*.

The *florikin* frequents long grass in preference to any other situation. It is sometimes met with in the grain-fields, also in fields of cotton and dholl, and in the Carnatic so much in those of the grain called *wanagon*, as to be named the " *Wanagon Bird.*"

It feeds chiefly in the morning, and is then easily raised, but during the heat of the day it lies very close, and is flushed with difficulty. It seldom flies far, but often runs a long way to escape being raised, especially on open ground. The chief food of the *florikin* is grasshoppers. I have also found blister beetles (*Mylabris*), scarabæi and other insects, and even occasionally centipedes and small lizards. I have sometimes, though rarely, heard it utter a kind of sharp *quirk* as it rose from the ground. It has also a kind of feeble plaintive chirp, or piping note when running. Its flesh is delicate, and of excellent flavour, and it is the most esteemed of the Indian game birds; and its pursuit is a favourite sport. From the open nature of the ground it frequents, it is well adapted for being hawked, and both the *Luggur* and *Shaheen* are often flown at it.

The egg is of a stunted thick ovoid form, very obtuse at the larger end, and of a dark olive colour.

Length of the male 18-19 inches; of wing 8; tail 4; tarsus hardly 4; bill front 1$\frac{3}{10}$ths; weight 16-18 oz.

Length of female 19½ to 21 inches; of one 20⅓; wing 9¾; tail nearly 5; tarsus 4½; bill front 1⅓; weight 20 to 24 oz.; bill dusky above, edges of upper, and all lower mandible, whitish. Irides pale yellowish; legs dirty whitish yellow.

FAMILY COLUMBIDÆ.—*Pigeons and Doves.*

GENUS PTILINOPUS, Swains.

283.—*P. Elphinstonii*, Sykes.—*Imperial Pigeon* of the Neilgherries.

I have hitherto only found this fine pigeon in the dense woods on the summit of the Neilgherries, in small parties, or single. It is a retired and wary bird. I found various fruits and small shells in its stomach. Irides ochre yellow. Length about 15 inches.

GENUS CARPOPHAGA, Selby.

284.—*C. ænea.*—*Col. ænea*, Auct.—*Pogonnah*, Mal.—*Imperial Green Pigeon.*

The *imperial pigeon* of Europeans on the West Coast is found in all the lofty forests of the West Coast, single or in small parties of 3 or 4. It feeds on various kinds of fruit, and has a single low plaintive note.

Irides and orbits, lake red; bill slaty, at base above red, at tip bluish white; legs lake red. Length 16 to 18 inches. I have never seen this bird with the knob on its bill as represented in books, nor have I heard of its ever being present.

285.—*C. cuprea.*—New species?.—*Copper winged Imperial Pigeon.*

I possess a single specimen of a fine pigeon shot in the Wynaad by Captain Pope, of the Bombay army, to which, if it be a new species, the above name may be applied. It might be considered as the young of the last, but its large size, and the testimony of other sportsmen of a *copper winged pigeon* found in Coorg, lead me to suppose it distinct. I add a brief description. Head, neck, and beneath pale lilac grey or dun colour; chin white; back and wings brownish, with a faint coppery gloss; rump dark glossy cinereous; quills and tail dusky black, the latter tipped with cinereous; under tail coverts, yellowish white. Irides, orbits and feet red; bill red at base, cinereous at tip. Length 18 inches; wing 9¼; tail 6¾.

GENUS VINAGO, Cuvier.—*Green Pigeons.*

286.—*V. militaris?*.—*Hurriala*, vulgo *Hurwa*, H.—*Common Green Pigeon.*

This, the largest of its genus found in the peninsula, is at the same time by far the most common and universally spread, frequenting not only jungles, but groves, gardens, and especially the fine avenues of old banian, and other trees that line many of the roads in the southern part of the peninsula. It associates in large flocks, feeding much on the fig of the banian, and various other fruit trees. When seated quietly they are very difficult to distinguish among the green leaves.

Many are often brought down at a single discharge even when only 1 or 2 were visible. The *green pigeon* has a high flavour, and is considered excellent eating. As there is some doubt about the descriptions of this bird, which is represented as having *red* legs, and as Gould has figured as one of the sexes of this, a totally distinct species not found in the peninsula, I here add a brief description.

Head and neck, blue grey; back of neck, yellowish olive, bordered by a narrow band of blue grey; chin and throat grey, tinged with green; back and wings olive green; shoulders bluish purple; breast and abdomen yellowish green, mixed with bright yellow towards the lower abdomen and vent; under tail coverts reddish cinnamon colour, edged with yellowish white; feathers of tarsus bright yellow; thigh coverts green, edged with whitish; tail entirely gray above; beneath blackish, with a broad margin of bluish white; feet saffron yellow; irides fine smalt blue, with an exterior circle of carmine; bill thick and strong, greenish white at base, bluish at the tip. Length 12 inches; wing 7½; tail 4.

In the young birds the under tail coverts are dusky green, edged with whitish, and this is the only material difference I have observed among numerous specimens from all parts of the country.

287.—*V. aromatica*, Auct.—*Marroon-backed green pigeon.*

I have only found this handsome green pigeon in small parties, in thick forest jungle in Malabar, and at the foot of the Neilgherries. One specimen differs somewhat from the others in having the face, forehead and chin yellow, the under tail coverts mottled with green and white, and in the bluish white tip of the lateral tail feathers being broader. This, I think, may be a young bird.

Bill and irides as in last: the former much more slender; feet and legs lake red. Length about 10½ inches; wing nearly 6; tail 4.

288.—*V. affinis.*—New species?—Young of last?

Descr.—Forehead and head grey; rest of plumage green; yellowish on chin; tail with centre feather green; exterior cinerous, with a black band near tip; under tail coverts barred with white and green; bill, irides, and feet as in the last; bill stronger. Length about 10½; tail 3½. This may be considered as the young of the last, which it resembles in size and form, but the absence of the rich marroon colour of back and wings, the fact of its being always found separate, and other circumstances, have induced me for the present to consider it as distinct. I have seen specimens of this pigeon in several collections made on the West Coast, but have only obtained it twice myself in forest jungle, and both times solitary.

289.—*V. bicincta.*—New species?—*V. purpurea*, Auct., Brown Ill. Zool.?—*V. vernans*, var., Less. Traité.—*Purple* and *orange breasted green pigeon.*

Descr.—Back of head and neck above blue grey; forehead, top of head, face, chin, throat, belly and rest of the plumage above, green of different shades; a broad band of orange or bright cinnamon yellow, on the breast, separated from the green of the throat by a light purple band; lower belly and vent yellow; some of the feathers streaked with green; under tail coverts entirely cinnamon colour: tail above grey, with a central dark band, and edged lighter; beneath almost black; whitish at the tip; edges of the wing coverts marked with yellow more broadly than in the other of this genus. Length about 10 inches; wing 6; tail rather more than 4; feet red; bill and irides as in others of the genus.

I have only seen this very prettily plumaged *green pigeon* in a tract of jungle near the sea coast, south of Tellicherry.

289, bis. V. *unicolor*.—New species?—Young of last?

Descr.—Above entirely olive green, except a shade of blue grey on the back of the neck; beneath and forehead yellow green, almost yellow at the vent; under tail coverts white, mixed with yellow and cinnamon; tail and wings as in the last. Length the same; wings and tail rather shorter.

I shot a single specimen of this pigeon in a grove of trees at Bimlipatam, in the Northern Circars, and have never again seen it. It is of the same slender make as the last species, and may be a young bird, but its very different locality has led me to place it separately for the present.

GEN. COLUMBA.

290.—*C. œnas*, L.—*Kabootur*, H.—*Blue pigeons.*

The blue pigeon abounds over all India, occasionally found in the more open spaces of jungles, especially in rocky districts, and in the neighbourhood of waterfalls—but more generally in the open country, inhabiting walls of villages, pagodas, wells, and any large buildings, and breeding chiefly in old walls.

Irides orange; legs red.

291.—*C. Javanica.*—*Bronze-winged Dove.*—*Imperial Dove* of some.

This very lovely pigeon somewhat approaches the turtles in form, and may be considered as a link joining them to the pigeons, from which it differs in having rather longer tarsi, and in the outer toe being slightly shorter than the inner.

It is a denizen of the thickest jungles, coming to the more open spaces to feed. I have seen it in Goomsoor, in Malabar and the Wynaad, and near the top of the Neilgherries, on the Coonoor pass. It feeds chiefly on the ground on various seeds, is solitary, a shy and wary bird, and of very rapid flight. Irides orange. Length nearly 12 inches.

GEN. TURTUR, Selby.—*Fachtah*, H.—*Doves.*

292.—*T. tigrinus.*—*Col. tigrina*, Temm.—*Chitroka Fachtah*, H.

This handsome dove is most abundant in the neighbourhood of, and among thick and lofty jungles. It is, however, also met with in groves of trees in the neighbourhood of the more wooded villages and towns, both in the Carnatic and Deccan.

Irides lake red; length about 12 inches, of which tail is 5. I have seen a nearly albino variety of this bird once or twice, being of a pinkish white colour throughout.

293.—*T. Cambayensis.*—*Col. Cambayensis*, Lath.—*Tortroo Fachtah*, H.

This little dove abounds over most of India, both in low jungles and near villages and cantonments, being found especially towards the north in every garden, and frequenting stable yards, houses, &c.

Irides dark brown.

294.—*T. risoria.*—*Col. risoria*, L.—*Dhor Fachtah*, H.

This large dove is found over all the country, frequenting hedges and trees in the neighbourhood of cultivation, also low bushy jungle.

Irides fine ruby red.

295.—*T. humilis.*—*Col. humilis*, Temm.—*Serotee Fachtah*, H.

Found, though more rarely than any of the last, over all India, frequenting groves of trees, hedge rows, &c. in the neighbourhood of cultivation.

Irides dark brown.

None of these four doves are gregarious, being generally found in pairs, though at certain seasons they occasionally congregate in flocks of various size.

296.—*T. meena.*—*Col. meena*, Sykes.—*Col. Turtur*, var. ?—*Kullur Fachtah*, H.

I have hitherto only found this species of dove in the jungles of Goomsoor, where it is tolerably abundant, associating in flocks of various size. It is enumerated by Mr. Elliot as found in the Southern Mahratta Country, but I did not observe it in the forests of Malabar.

Irides orange. Length 13 inches.

(*To be continued.*)

II.—*List of Minerals for presentation to the Society, collected from various parts of the Nizam's territories, Ceded Districts, Kurnool, the Southern Mahratta Country, Mysore, &c.—By Lieut.* T. J. NEWBOLD, *23d Light Infantry.*

No. 1.—A. Gneiss of Dummul at the base of the Kupputgode hills, Southern Mahratta Country, the weathered transition gneiss of Christie.

No. 1.—B. Not weathered variety, same locality, with pale rose-coloured felspar.

2.—Mica schist, compact variety, Kupputgode hills. Before the blowpipe, *per se*, in the platinum forceps, this rock fuses into a black enamel.

3.—Yellowish brown jaspery chert, same locality as the above, used by Hyder and Tippoo for gun-flints; fracture conchoidal, translucent at edges.

4.—Basanite, or flinty slate traversed by quartz veins, associated with the schists of the Kupputgode range.

5.—Latcretoidal rock, into which the higher and more ferruginous portions of the schists, composing the Kupputgode hills, pass.

6.—Black oxide of manganese, combined with oxide of iron and alumina; with decomposing quartz and felspar veins: thee xterior exhibiting a disposition to the botryoidal structure.

7.—Variety of the above.

8.—Do. do.

9.—Porphyritic chlorite rock. Pale rose-coloured crystals of felspar imbedded in a siliceous paste, coloured by chlorite; some of the crystals decomposing into a whitish clay. This rock is associated with the siliceous chlorite schist of the Kupputgode hills. Although, petrographically considered, it might be correctly pronounced a porphyry, yet I have preferred the name just given it, as more in keeping with the geognostic position of the rock. This rock I have seen in various parts of Mysore and the Ceded Districts, associated with granite and the primary schists.

10.—A. Chlorite slate, same locality.

10.—B. Do. siliceous variety, exhibiting the tendency of this rock to split into rhomboids.

11.—Siliceous mica slate, same locality, showing traces of copper.

12.—White sub-crystalline limestone—the more granular varieties closely resemble Carara marble—in veins in the schistous diorite, Kupputgode range.

13th.—Do. do. altered in colour, near line of contact with the slate.

14th.—Rhomboidal calc-spar, same locality.

15th.—Singular calcareous rock; composed of minute angular fragments of a dark glistening quartz, and crystals of pale flesh-coloured felspar, cemented together by a greenish, granular, sub-crystalline paste, composed chiefly of carbonate of lime. It occurs in a hill near the village of Hurti, on the southern flank of the Kupputgode range, not far from the Putwurden's territory. The hill has a mammiform shape, having its surface covered with detached angular and rugged masses of this rock, which appear to have been subjected to the action of violent disruptive force. It is very likely to be mistaken, from the colour, hardness and granular texture, for a variety of massive siliceous chlorite rock, and in some specimens resembles diallage and serpentine; but on the application of a lens, and indeed by the naked eye, on closer inspection, its true aggregate character may be distinctly recognized. The application of dilute nitric acid to the rock in substance excites but a feeble effervescence; but on the powder the extrication of carbonic acid gas is abundantly evident. It often imbeds cubic pyrites of iron. The felspar, the dark quartz crystals, and dull green hue of the rock, possibly indicate its origin from the chloritic slates of the Kupputgode hills.

16.—Variety of the foregoing, less crystalline in texture, imbedding cubic brass and liver-coloured pyrites. Colour, dull green, with reddish brown delineations, assimilating some varieties of serpentine. From the minute glittering scales of mica, observable in this rock, and its softer texture, it would appear to have been formed out of the debris of the neighbouring mica slate. It effervesces with the dilute mineral acids: before the blow pipe, *per se*, it phosphoresces slightly, and exhibits on its edges shining points of black enamel. The compact varieties of this rock are susceptible of a high polish, and are used as an ornamental building stone. Some of the exquisitely polished slabs in the elaborately sculptured little mosque in the town of Lachmaisir, in the territory of the Mahratta Chintaman Row Putwurden, are of this stone, retaining the pyrites which shine like so many spots of gold on its polished surface. The chlorite slate too of this part of the Southern Mahratta Country imbeds pyrites.

17.—Variety of the above, with cubic liver and gold-coloured pyrites, projecting from the weather-worn surface. None of these rocks have been noticed either by Christie or Colonel Sykes.

18.—Clay slate of Darwar, red and white, noticed by Christie, composed principally of decomposed felspar, more or less coloured with iron, and having a loose aggregation. Chlorite also occurs; and to the presence of this mineral may be attributed the peculiar shining flaky structure, and the greenish tinge of many of the surrounding slates.

The specimen is from a bed of slate that has suffered considerable flexure from the intrusion of a dyke of basaltic greenstone, and from its softness assimilates the character of a shell or slate clay. Before the blow-pipe the whiter portions melt, *per se*, into a white enamel; the red parts blacken at first, and fuse with some difficulty into a shining black slag, more or less affected by the magnet.

19.—Dark blue roofing slate of Kulladghee, occurs both laminar and massive, it is easily cut by the Wudras on the spot into excellent writing or roofing slates. Some varieties are so massive that pillars, many feet in height, are quarried from it, and some so finely lamellar that leaves, two or three feet square, almost as thin as pasteboard, may be separated. A capital writing slate and pencil were cut for me out of the quarries, and shaped and polished, all in a couple of hours. This formation furnishes good hones ; specimens of which I have already furnished.

20.—Variegated clay slate, penetrated by calcarious infiltration, associated with transition limestone of Kulladghee.

21.—Chlorite slate, of Kittoor.

22.—Talc slate from the Falls of Gairsipa, Western Ghauts, reddish grey ; less weathered portions, greenish grey ; streak nearly white, sectile, greasy feel, structure laminar tables, glimmering lustre, translucent at edge, easily frangible. Almost infusible before the blow-pipe, the plates separate and whiten.

23.—Actynolitic schist, associated with the talc, mica and hornblende schists at the Falls of Gairsipa. Minute acicular crystals of actynolite, without any common direction, distributed irregularly throughout the structure of this rock, impart a glimmering appearance ; a few scales of mica are disseminated : colour grass green, feel harsh, easily frangible, fracture granular, inclining to slaty, streak greenish grey. Before the blow-pipe, *per se*, it first whitens and finally fuses into a green enamel.

24.—Hornblende schist or schistous diorite, Falls of Gairsipa, identical with the rock described by Christie, as consisting almost entirely of hornblende.

25.—Mica schist, Falls of Gairsipa.

26.—Do. do. imbedding decaying garnets in dodecahedrons.

27.—Mica schist passing into gneiss—same locality as the above.

28.—This is the rock described by Christie, as being a variety of granite, which differs from the common granite of India, and as not being so old ; composed of small grains of white felspar, quartz, and mica ; has, in some instances a slaty appearance, and is associated with gneiss and hornblende schist.

From a careful examination of this rock and its associated schists, *is* *situ*, and from its decidedly stratified character, I should rather be inclined to pronounce it thick bedded or granitoidal gneiss; in some hand specimens, however, it is not to be distinguished from true granite. It is an interesting specimen to the advocates daily gaining ground, of the theory of the mineral metamorphism of rocks, constituting one of the almost imperceptible gradations by which a normal rock is supposed by Keilhan and others to pass into rocks, generally considered abnormal, or in other words involving doubts as to the plutonic origin of granite. Gairsipa, not only affords to the geologist an instructive and beautiful exposé of the rocks of the gneiss and mica schist system, the dip and direction of strata, but affords to the lover of nature, the magnificent spectacle of one of the most stupendous (in point of height) cataracts on the face of the globe, tumbling over a precipice of these rocks more than eight times the height of the celebrated Falls of Niagara. The breadth of the river above the Falls is about 300 yards; it was full from bank to bank at the time of my visit: the depth of the stream on the average about 10 feet. The sheer height of the scarp over which the waters were precipitated, according to careful measurements, twice repeated, communicated to me by Mr. T. Lushington, 888 feet to the surface of the water in the basin, and the depth of the basin 300 feet, making a total of 1188 feet. The height of Niagara is about 140 feet, but the breadth of the river far exceeds that of Gairsipa.

29.—Gneiss of Gairsipa, hornblende replacing mica, which appears in scales, disseminated among the former mineral.

30.—Variety do. do.—same locality.

31.—Gneiss passing into hornblende schist—same locality.

32.—Talcose pot-stone (*lapis ollaris*), associated with the talc slate in the S. E. part of the Darwar district. Christie observes, that all "the fine plaster with which the walls of the houses are covered in India, and which is so much admired by strangers, is composed of a mixture of fine lime and soapstone, rubbed down with water: when the plaster is nearly dry, it is rubbed over with a dry piece of soapstone which gives it a polish very much resembling that of polished marble." This stone I have also found associated with asbestus in the talcose slate of the western parts of Mysore: it is cut into pencils and used by the natives for writing on cloth, stiffened and prepared with charcoal, and is held in holy estimation both by the Brahmins, the Jangams and laity of the Lingayet sect. By the former it is hollowed out into vessels used in preparing their food, and by the latter for their phallitic emblem, which is preserved inviolate from unhallowed gaze in the small silver box, which the worshippers of the *lingum* invariably carry about their perons for the purposes of adoration. Some varieties are used in parts of the Ceded Districts and Mysore to grind the sandal wood into powder, for the composition of the *ticá*, with which some castes of the natives mark their foreheads. An argillaceous variety procured between Tarputtri and Cuddapah is carved, like the agalmatolite of China, into images representing the whole Hindu pantheon, avatars of Vishnu, &c. The darker and more compact varieties often assimilate serpentine, and take a fine polish. This stone is in great request for the larger kind of idols that usually sit or stand enshrined in the *Vimanas* of Hindu temples, and many of the ancient inscriptions of the Southern Mahratta Country, Mysore, the Nizam's territories, are engraven on pillars or blocks of this mineral. Some of the beautifully polished pillars, and inscribed slabs in the ruined temples of the old Hindu capital of Bijanugger and Annagundi are of this stone. In Mysore, whole temples are constructed of it. The dark coloured stone, of which the pillars supporting the elegant mausoleum of Hyder and Tippoo, near the Lal Bagh at Seringapatam, are composed, appears to me, after a close examination of the pillars themselves and the quarries at Turivicary, whence the stone was brought, to be a highly indurated ferruginous, and crystalline variety of this rock, having some of the characters of a serpentine, rather than the basaltic or hornblende rock, which Buchanan and Benza have severally pronounced it to be. Specimens of this variety taken from the quarries of Turivicary, and also of the potstone of Mysore, I have forwarded for presentation.

33.—Marble from Kulladghee, pale flesh-coloured, occurs in beds and veins in the surrounding slates and limestone, assimilating in texture, colour and fineness of polish the Tiree marble, but does not imbed mica, hornblende, or sahlite: chlorite, however, is sometimes seen in their greenish seams. Specimens of the lithographic limestones near Kulladghee and Bagalcota, have been already transmitted to the Society.

34.—White marble from Bagalcota, streaked with green chloritic zones resembling the antique Cipolin marble.

35.—Lithographic limestone from Kurnool, imbedding stalactiform oxide of iron.

36.—White marble from Kulladghee.

37.—Drab-coloured limestone from Talicota, in the Rastea's territory, laminar and compact, exhibiting delicate arborescencies between the laminæ, or layers of deposition.

38.—Crystalline limestone, approaching marble in texture, from Kurnool. Colour mottled green and white; translucent in thin fragments, difficultly frangible, some varieties are so hard as to give fire with steel, fracture granular crystalline. This stone is susceptible of a fine polish, and might be employed with advantage in ornamental slabs for inscriptions, vases, &c. It occurs near the line of contact with the schistous chlorite, from which it probably derives its peculiar hardness and colour.

39. Lim estone of Kurnool altered by contact with the schistous chlorite; colour, dull green, streaked with dark purplish ferruginous bands; fracture granular, sub-crystalline, extremely tough under the hammer, effervesces feebly with dilute mineral acids. Some varieties imbed pyrites and assimilate serpentine. It occurs at Kurnool, and on the tongue of land between the confluence of the Tumbuddra and Kistnah rivers.

40th.—Quartz rock of Darwar, coloured with iron, and containing nests of decayed quartz and felspar, passing into kaolin, and often tinted yellow, brown, and reddish by oxide of iron. In the hilly zone extending between Kittoor and Darwar, there is a variety that exactly resembles the rock composing the upper portions of the copper mountain and Sondur ranges, being of a jaspery and highly ferruginous clay, sometimes passing into a true ore of iron, with a cherty quartz in alternate layers, generally on their edges, and varying from the eighth part of an inch, to an inch in thickness. The laminæ are frequently contorted and bent, and impart a curious waved or striped appearance to the rock. It occupies a similar geognostic position, and is seen generally cresting the slaty hills around Kittoor. Sometimes, as Christie accurately observes, the base of the rock is white or grey, and traversed in all directions by dark brown-coloured veins, highly impregnated with iron: but in some specimens, the dark brown variety is in much larger quantity than the white basis; and then the latter appears as if it had been broken into a number of small angular fragments, which had afterwards been united by the consolidation of the brown variety from the fluid form. This variety contains numerous small cavities which are lined with red hæmatite in the shape of stalactites, or having a blistered, or mammillary form. The cavities are generally very small. This rock in petrographical structure and geognostic position, we may safely pronounce to be identical with that composing the precipitous sides of the Bimagundi pass into the Sondur valley (described at page 147 Journal No. 20); and associated with it, we find, near Kittoor, as at Sondur, a magnetic iron ore with polarity, exhibiting a similar laminar structure and a like tendency to split into rhomboidal paralellograms.

41.—Breccia, of the old red sandstone formation of Christie, from the north bank of the Malpurba, Southern Mahratta Country; a reddish brown quartzy paste imbedding angular fragments of white and reddish quartz, with felspar disseminated.

42.—Do. do. a ferruginous paste, cementing fragments of a decomposing chert, apparently from veins in the associated limestone; the paste approaches a true iron ore, and contains small cavities lined with a mammillary hæmatite.

43.—Pudding-stone from the old red sandstone formation, north of the Malpurba :—rounded pebbles of quartz rock imbedded in a crystalline reddish brown sandstone.

44.—Diaphonous quartz with a bluish tint, mentioned by Christie, associated with the sandstone; from the hill south of Kulladghee and near Padshapoor. I have forwarded specimens of the white variegated sand stones of Badami and Mudibhal.

45.—Alum in whitish earthy superficial efflorescences between the laminæ and on the air-exposed surfaces of a purplish aluminiferous shale, alternating with the old red sandstone, in the cliffs at the falls of the Gutpurba near Gokauk. The occurrence of this mineral in the formations of the Southern Mahratta Country appears to have escaped the observations of Marshall, Christie and Sykes. It is found in the lower portions of the cliffs, constituting the precipice over which the Gutpurba rolls on its passage to the low country, through which the Kistnah flows, at the bottom of one of those singular and deep fissures that clear the sandstone rocks from summit to base. The shale in which it occurs is a common slate clay, of a purplish brown hue, and tastes, generally, distinctly of alum, which, however, rarely appears in an efflorescent state, save on air-exposed surfaces: it does not resemble in the slightest degree the globular greyish black alum slate of Europe, nor its bituminous aluminiferous shale. I have also discovered alum and common salt in the rocks of the copper mountain range in a similar efflorescent state, in a rock, resembling somewhat the glassy alum slate of mineralogists, but cellular, ferruginous, and exhibiting purple and yellow iridescent hues. Captain Arthur informed Sir Whitelaw Ainslie that he discovered alum in Travancore, in a soft dark coloured laminated earthy matter, which contained sulphur in the state of sulphuret of iron; and that at certain depths in the soil, under the laminated matter, he observed a regular stratum of charcoal, a circumstance which led him to conjecture that the bed in which the mineral is found is of a vegetable origin; and we know that it has been ascertained by Vauquelin and others that in what is termed the alum ore of *La Tolfa*, potass is met with in considerable quantity. Alum is associated with the coal measures and bitumeniferous rocks of Europe, its existence therefore in the sandstone rocks of the Southern Mahratta Country may be regarded with some interest, as indicative, if not of the existence of coal, at least of the age of the formation. Alum, we are told by Dr. Davy, exists in certain caves in the interior of Ceylon. Mr. Elphinstone states that it exists in the clay of Calabaugh in Cabul, and according to Captain Macdonald Kinneir it is found in the mountains south of Kelat, in the province of Mekran. It is also brought in considerable quantities from the mountains of Nepaul, where according to Mr. Campbell, it is said to exude from the surface of soft rocks, and sometimes to be dug out of their substance; from these sources it is collected in considerable quantities, during the cold and dry seasons, and carried by the *Bhoteahs*, *Murmis*, and other hill people, to Katmandu, to be exchanged with the merchants of that city for money or other articles. Mr. Campbell also informs us that there is a dark bituminous substance, used in Nepaul, said to be exuded from rocks; which is called black alum or *salajit:* it resembles, in external character, the bituminous alum ore which is said to be found in Sweden, and in many coal mines in England, but there is much vegetable matter in it, although the Nepaul physicians believe it to be a mineral. Alum also exists in Behar, where it was discovered by Dr. Buchanan, and also in the Vindhya mountains, but the great bulk of this valuable mineral, which is used extensively by the natives of India in medicine and the arts, is imported from China.

46.—Secondary trap of Christie, from the vicinity of Belgaum—vesicular.

47.—Amygdaloid (same locality) imbedding zeolite and calc-spar. A more compact variety occurs imbedding nodules of calcedony. This rock escaped the observation of Christie, who states he never saw the amygdaloid in sitû.

48.—Lateritic conglomerate, capping slate and limestone of Kulladghee.

49.—Laterite of Beder—Nizam's territory.

50.—Variety do., exhibiting interior of tubular sinuous cavities, having a greyish green indurated enduit.

51.—Variety do. do. compact—Beder.

52.—Do. do. near the line of contact with flœtz trap—Beder.

53.—Do. do. with a somewhat cancellar structure—Beder.

54.—Indurated lithomarge bed, between laterite and trap—often calcareous—Beder.

55.—Variety of laterite with cavities filled with white lithomargic earth —Beder.

56.—Purple lithomarge in laterite of Beder.

57.—Flœtz trap, near the line of contact, where the laterite is seen superimposed—Beder.

58.—Basalt underlying laterite cliffs of Beder.

59.—Termination of black veins in the laterite of Beder, near its junction with the trap, in combination with iron and alumina.

59 A.—Black oxide of manganese in combination with iron, from veins in laterite of Beder.

60.—Lateritic conglomerate, capping laterite of Beder. It exactly resembles a similar rock, distinct from the true laterite, capping the laterite of the ghauts and Western Coast, composed of ferruginous nodules, cemented together by a felspathic paste of various shades of yellow, brown, and red, coloured by oxide of iron. This rock occasionally presents a shining glazed-like surface. In tracts where travertine and limestone prevail, as in the vicinity of Bijapore, and Baugwari, the lime often enters the cement of this conglomerate.

61.—Nodule in laterite of Beder, imbedding a mineral, with a green and purple iridescent hue, probably iron.

62.—Laterite of the western ghauts—Devamani pass, Upper Canara.

63.—Lateritic conglomerate, capping laterite of the western ghauts, summit of Hossdroog pass, Upper Canara.

64.—Laterite of the Western Coast, quartzy variety, from Onore. Specimens of this rock from the Malayan Peninsula, Cannanore, Mangalore, the Bisley and Heggalla Passes, the lateritic rocks capping the slate and sandstone ridges of the Ceded Districts, the neighbourhood of Bangalore and Nundidroog, &c. have already been transmitted.

65.—Variety of laterite from Onore—felspathic.

66.—Do. do. Western Coast, from Compta, north of Onore, exhibiting the externally black superficies, so often noticed in the weather exposed masses of this rock.

67.—Variety from base of western ghauts, near Meerjan.

68.—Do. do from the vicinity of Soonda, in Upper Canara.

69.—Do. do. from Banwassi, in Upper Canara, near the western boundary of Mysore.

70.—Lateritic conglomerate, capping the laterite cliffs which overlie the flœtz trap formation of the Deccan ; hills near the city of Gulberga—Nizam's territories

71.—Greenish white felspathic sandstone, of an earthy friable texture, with small angular fragments of quartz, associated with the overlying trap at Bangwari, near Belgaum. It sometimes imbeds dark ferruginous nodules in a state of disintegration.

72.—Travertine with dendritic appearances, between Hyderabad and Beder.

73.—Amygdaloid associated with the great overlying trap formation of the Deccan, containing globules of a species of zeolite, resembling apophyllite in its behaviour before the blow-pipe—frosted pearly exterior, and peculiar splendent planes. It exfoliates, curls, and froths, before the blow-pipe, and finally melts into a white enamel. This amygdaloid also contains calc-spar, mesotype, and stilbite. It is from Ipperghi, near the boundary of the Solapoor Rajah's country.

74.—Stellated zeolite in rhomboidal calc-spar, Solapoor territory. This is an interesting specimen, showing the gradual pseudo-morphic changes of the two minerals. A white zone appears to define the limits of each, beyond this they become in a certain degree blended: the zeolitic rays may be seen decussating and diverging from their several centres, through the transparent substance of the calc-spar.

75.—Radiated zeolite—rolled fragments from the bed of the Bhima—Nizam's territories.

76.—Red jasper from the Kistnah—do.

77.—Yellow jasper from the Malpurba—Southern Mahratta Country.

78.—Mocha stone, enclosing nest of quartz, bed of the Bhima.

79.—Cornelian—bed of the Kistnah, at Paugtoor.

80.—Calcedony—botryoidal, from the vicinity of Ipperghi—Solapoor Rajah's territory.

81.—Oriental agate.—Numerous specimens of this beautiful mineral, some assimilating the onyx, sarde, and sardonyx, I have already forwarded to the Society, as also of glauconite, various kinds of zeolite, chrysoprase, heliotrope, &c., occurring in the flœtz trap formation of the Deccan.

82.—Agate imbedding quartz.

83.—Moss agate—bed of the Kistnah, at Paugtoor.

84.—Amethystine quartz crystal, from Golconda—Hyderabad.

85.—Do. do. from Cupputral, Ceded Districts, where the sandstone comes in contact with the granite.

86.—Pale buff coloured sparry limestone, associated with the overlying trap formation of the Deccan and the laterite. Locality, hills of Ingliswara, near Baugwari—Bijapore territory.

87.—Variety—reddish.

88.—Limestone, greyish white, imbedding broken fragments of bivalved shells, converted into chert, associated with the overlying trap formation near its southern limit, between Hyderabad and Beder.

89.—More compact variety—same formation near Firozeabad, Nizam's territory, imbedding both univalve and bi-valve shells.

90.—Do. do. same formation from the vicinity of Koolkondah, presented by my friend Lieut. Wyndham.

91.—Do. do. pale buff coloured, imbedding nummulites.

92.—Variety, whiter and more crystalline. Both the last named specimens were found on the river bank at Onore on the Western Coast, and, if credit may be attached to enquiries made on the spot, were brought thither by native trading craft from the coast to the northward as ballast. Fossiliferous limestone, we know, occurs in the Kattywar peninsula, and the island of Perim, but the natives assured me the nummulitic limestone at Onore, was brought from places considerably to the south of these places. It is possible, however, that the spot where they were picked up by the native boatmen is at some distance from their true situs, as all the fragments have a rolled and water-worn appearance, as if they had been washed by the tidal wave on a sea coast. A piece of coral rag with shells *(ostrea)* adherent, was also picked up among the fragments of limestone at Onore. It would be matter of some interest to ascertain from the boatmen themselves, the exact localities where they took in these stones as ballast. My visit to Onore was extremely brief, and during the monsoon, when no boats can approach the coast, and all trade by sea suspended. Nummulitic limestone occurs at Chirra Punji. Burnes observed nummulites in the limestones of the Chari range at Liseput, in Cutch. Mr. Colebrooke first brought this rock to notice in 1824. It was met with at the foot of the Kasya mountains. Shell limestone, I believe, was discovered in the Madras presidency by Colonel Cullen, at Paddapangallee, in the Northern Circars, underlying basalt, and in the Hyderabad territory, by Voysey, in 1819-20. Malcolmson and Benza have since added to these discoveries.

93.—Hexahedral pyramid of adamantine spar, bluish white, from the Corundum pits, in the west of Mysore near Gram. This mineral is almost confined to India and China, and has been long known in the former country under the term of *Korund*—hence its European name. It is used principally in India, Ceylon and Arabia, for polishing precious and other stones. The oriental ruby, sapphire, and topaz, are varieties. Corundum occurs in Ceylon, Mysore and Cuttack; it is rare in Europe, though a sub-species, emery, is found in abundance on the island of Naxos, near Smyrna and in Saxony.

94.—Green copper ore (malachite) from the copper mountain near Bellary. Before the blow-pipe, *per se*, it decrepitates, but finally fuses into a reddish brown mass, containing a bead of pure copper. Treated with acids it affords from re-agents the usual indications of this metal.

95.—Iron glance, imbedded in white quartz, from the hills of Cupputral, Ceded Districts, the *fer oligiste* of French mineralogists. Before the blow-pipe, *per se*, it blackens and becomes affected by the magnet. Iron glance yields an excellent malleable ore.

96.—Granular magnetic iron ore, from Mutpalle—Nizam's country.

97.—Red hematitic iron ore, from the iron clay near Kondassur- Nizam's country. The iron produced from the two last named varieties is used when blended to produce the celebrated wootz steel, which is exported to Persia and Arabia for sabre blades.

98.—Specular iron ore—Sondur hills, Ceded Districts. It, as well as the micaceous iron ore, is often sold as *surmah*, or antimony, in the bazaars of Southern India, and applied in the state of a powder to eyelids of women and children.

99.—Lead ore (galena) near Jungumrazpilly, in the Nulla Mulla hills, north of Cuddapah, said to be combined with silver and antimony.

100.—Gold dust in magnetic iron sand with menaccanite, silver and copper ore (and platinum ?) in the bed of the Doui rivulet, Kupputgode hills, South Mahratta Country.

101.—Native silver—same locality.

102.—Grey silver ore—do.

103.—Green carbonate of copper—do.

104.—Native copper—do. do.

105.—Tin ore (oxide) from Malacca.

106.—Diamond alluvium; from the diamond pits at Ramulacota—Kurnool.

107.—Do. do. last washings.

108.—Cacholong, milk white, opaque, fracture semiconchoidal. This specimen presents both the hard and the soft earthy varieties, noticed by Brongniart in the cacholongs found by him at Champigny, the former exhibiting a shining fracture, while the latter is chalky, light, and adheres to the tongue.

109.—Brown indurated clay, imbedding quartz crystals, and covered with yellowish annular and lenticular delineations, assimilating organic remains, associated with laterite, resting on the flœtz trap of the Deccan, south of Bijapore.

*110.—Mineral from edge of trap dyke, near Tallapodatoor, Ceded Districts.

111.—Nodule of indurated clay from lateritic formation—Nellore.

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* I regret leisure will not admit of my noting this mineral.

112.—Asbestiform tremolite, found in veins, with adularia and magnetic iron ore in mica slate—Adepuram, Nellore mining district. It occurs in minute diverging fibres, with silky lustre, often stained by oxide of iron, frangible, scratches glass with difficulty, phosphoresces slightly, and whitens before the blow-pipe.

113.—Adularia associated with the above; scratches glass, lustre splendent, rather vitreous on the perfect planes, and pearly on the broader lateral planes. Before the blow-pipe, *per se*, it whitens and fuses on thin edges into a transparent glass. It is about 6° hardness of Mohs.

114.—Do. imbedded in kunker—same locality as the above.

115.—Variety of iron ore, resembling externally the titaniferous iron ore of the Neilgherries; after exposure to a red heat it becomes magnetic. It occurs in compressed laminæ, in seams of a garnetic quartz bed in the mica schist at Kunchgarlconda—Nellore.

116.—Garnetic quartz bed in mica schist—Kunchgarlconda.

117.—Honey-combed quartz: most of the cavities are filled or lined with an orange brown powder, which, before the blow-pipe, blackens and becomes magnetic.

118.—Quartz with magnetic iron ore foliated, garnets and mica, and exhibiting traces of copper, Ademulepuram—Nellore.

119.—Do. do. with rhombic dodecahedral garnets, resembling essonite.

120.—Granular garnet rock—same locality. This rock from its apparent weight, hardness, colour and tendency to take a crystalline form, might easily be mistaken for granular corundum at first sight. It is finely granular in structure, and has the appearance of a purplish red jasper. It often occurs in nodules which assume a rudely dodecahedral form or prisms, with three sided summits. It occurs in beds in the hornblende and mica schists of the Nellore mining districts, near Gurumanypenta, associated with asbestiform tremolite and adularia. Like precious garnet, it fuses, *per se*, before the blow-pipe into bluish black enamel.

121.—Red mineral in shining plates, resembling felspar, between laminæ of mica schist, base of Udeghirry mountains—Nellore. Softer than felspar, streak reddish white. Before the blow-pipe, *per se*, fuses easily with intumescence and phosphorescence, and curling up into a white enamel; with phosphate of soda into a topaz coloured glass, which becomes colourless on cooling, and with borax into a faint greenish glass, which also loses its colour on cooling.

122.—Pale rose coloured quartz—same locality.

123.—Gravel, brought down by mountain torrents, containing rolled and angular fragments of iron ore, garnets, schists, and copper ore.

124.—Mica schist with garnets and carbonate of copper—Gurumanypenta, Nellore mining district.

125.—Carbonate of copper in layers in hornblende schist—Bungeral Mettah, Nellore mining district. Mr. Prinsep thinks the phenomenon of the ore alternating with the hornblende interesting in a geological point of view, as affording exactly the appearance of gradual deposition from a liquid, at this earliest period of geological formations. But when we see, as in some specimens of this very rock, the ore running through it in fissures and lines nearly perpendicular to those of stratification, we must look to some other cause than a mechanical deposition from a liquid to account for its occurrence in such situations, and pause ere we pronounce the ore to be coeval with the primary rock which imbeds it.

126.—Mica schist, in which the mica is, in part replaced by innumerable small garnets, imparting a granular structure to the rock.

127.—Specimens of the copper ore, principally from Gurumanypenta, Bungeral Mettah, Salighirry and Yerrapully—Nellore: they present for the most part the carbonate passing into malachite and mountain blue. Some fragments have a quartzose matrix; both coloured green, and appearing so, from the imbedded ores—another variety runs in veins through a dark red oxide of iron, which Prinsep considers, to be the same as that of Dr. Thomson's specimen. (These ores have been analyzed in England, by Dr. Thomson, and more lately in India, by Mr. Prinsep, vide Madras Journal, for April 1836, p. 154). The mixture of sulphuret of iron, according to Prinsep, and perhaps of copper, with the oxide, gives the whole a dark arenaceous character. The first ore yielded 30.2 per cent of metal, and the last 39.5.

128.—Copper ore with grey metallic lustre internally, and penetrated with green streaks: probably the combination of the carbonate and sulphuret, mentioned by Prinsep as the richest ore met with, and yielding 69 per cent. of pure copper; highly malleable; specific gravity, intermediate between the carbonate and sulphuret.

129.—Schorl crystallized in prisms with quartz, mica and traces of copper: much finer crystals of this variety of tourmaline may be obtained from the locality whence these were obtained, but I had not the means of detaching them from their bed, which occurs in the mica schist of Bungeral Mettah, Nellore mining district. This variety of schorl *differs* slightly from that of Europe. It melts into a greenish grey enamel, instead of a black slag—hardness between quartz and topaz. With borax it fuses into a transparent glass tinged green.

130. Dark brown calcareous rock, structure passing from earthy to that of a fine indurated clay, associated in thin overlying beds with the plumbiferous limestone of Yungumrazpilly. It imbeds whitish tubular bodies, lined with minute whitish crystals (organic exuviæ ?).

131.—Do. do. with quartz and decomposing iron pyrites.

132.—Nodule of iron ore (magnetic) from Kunchgarlconda, Nellore, granular metallic lustre; colour brownish black, streak brown, opaque, fracture uneven, infusible before the blow-pipe, *per se*, with borax it melts into a green glass.

133.—Quartz rock—Udeghirry Droog.

134.—Asbestus, in masses of fibres, passing from a dull greenish grey to a yellowish white mottled colour, with a slight soapy feel. Tough under the hammer, and breaks into fibrous woodlike fragments, which are not flexible in an unseparated state. It is found in a bed at Putsa Marculpilly, near Rayel-cherroo, Ceded Districts, in limestone, associated with a white indurated magnesian clay or earth. Before the blow-pipe, it fuses into a greenish grey enamel, which by a continuance of the reducing flame is converted into a brown slag.

135.—Magnesian earth indurated, associated with the above—same locality.

136—Indurated earthy vein in mica slate—Bungeral Mettah, Nellore. Colour faint reddish, white with scales of mica disseminated, effervescences feebly with acids.

Actynolite, carbonate of magnesia, and kyanite, occur in the mica and hornblende schists of the Nellore mining district, also a magnetic iron sand which is smelted, and abundance of hematitic iron ore. The soil often presents a sterile waste from the saline effervescences of the mineral alkali; muriate of soda, and saltpetre, often attending metalliferous development.

III.—*Remarks upon the Auriferous Deposits of India, considered with especial Reference to their Economical Value.—By* Frederick Burr, *Esq.*

My attention having some years ago been directed to the geological structure and mineral capabilities of India, one of the facts which then struck me with regard to the latter subject, was the very extensive occurrence of auriferous deposits in various parts of the Indian peninsula. The impression made upon my mind at the time with regard to the immense diffusion of this metal, has during my residence in this country been fully confirmed—it is an important, though almost unheeded fact, that gold is very generally distributed, though in sparing deposits, throughout extensive tracts in India, extending from the tenth to beyond the thirtieth degree of north latitude. There is every reason to believe, therefore, that this metal might be made a new source of revenue to the state, of wealth to the country, and a profitable object of occupation to its population, were sufficient skill and attention devoted to the subject. It is with this object in view, that the following remarks have been written.

From the comparative rarity of practical science, among those observers to whom we are chiefly indebted for our knowledge of Indian mineralogy, it is not, I fear, possible to obtain from the details they have furnished us, any very clear or definite knowledge of the *actual richness* of these gold tracts. They are generally described as being poor, and containing the precious metal in very small proportions, but the poverty of metallic ores thus expressed, is entirely a relative term, and liable to much ambiguity. What it would be desirable to know, is the actual quantity or *per centage* of the precious metal, which can be extracted from a given quantity of mineral matter; with this datum we might form a correct idea of the value of the mineral, though it would still be desirable to know the cost of production, and the means of washing or reduction employed, as after all much would depend on the greater or less perfection of these processes. Gold except in a few rare cases, is always found in very sparing quantities, compared with the mass of sand, veinstone, or other mineral substance which accompanies it; which is in fact the principal cause of the high relative value of this metal: yet many auriferous deposits are by good management made to yield a profit by the skilful mining Engineer, which to the uninstructed eye would appear either totally destitute of the precious metal, or so poor as to be absolutely worthless.

Without attempting to describe, or even to point out every locality in this country, where gold has been ascertained to exist, I shall commence by briefly enumerating such of those tracts as now occur to me, and will most readily confirm my views of the abundant distribution of the precious metal throughout a large portion of the Indian peninsula.

Taking first the Madras presidency, gold is well known to occur in Coimbatoor, in numerous localities on the western and southern declivities of the Neilgherry mountains, and other parts of the Malabar Coast, where it is commonly found disseminated in small particles in the sands and beds of rivers, and may be estimated to spread over an extent of several hundred square miles, forming the principal gold tract of Southern India. In the high table land of Mysore, gold is known to exist in many places, as near Bangalore and Chinnapatam, and in the Wynaad district. In the Southern Mahratta Country, the existence of gold is well known, and the deposits of the Kupputgode range have been described in the "Madras Journal of Science," by an energetic labourer in the field of Indian geology—Lieutenant Newbold. In the Northern Circars, and the Rajah of Berar's territory, gold is described as existing in many of the rivers, especially in the Nagpore district, almost the centre of India. I have also been informed by W. H. G. Mason, Esq. that the natives obtain a little gold by washing, in the streams near Vizagapatam.

This very brief and imperfect review of auriferous localities within the Madras territories, would be amply sufficient for our present purpose; yet it is deserving of notice, that these deposits of the precious metal, are equally abundant in the northern portion of the Indian peninsula as in the southern, as I shall now proceed to show.

Gold is known to exist in the tributaries of the Indus, in Kumaon, where it is obtained by washing in the streams in the vicinity of Kalsee. That these auriferous particles are derived either from the rocky escarpment of the Himalayahs, or the mountains subordinate to them, is highly probable, as gold mines are described as being worked by the Chinese Tartars north of these mountains near Hurtoh, beyond the lake Mansuraor. These gold workings are said to have been stopped by order of the Chinese government, lest the precious metal should be the means of tempting us across the snow clad pinnacles which bound the British territory. Gold is stated to occur in great abundance in Assam, where it is profitably worked by the natives at Gowhetti, on the Bramahputra. From this point deposits of gold are well known to extend southward through the Burmese empire, the Malayan peninsula, and the adjoining islands, but these localities it would be foreign to my present purpose to notice.

Of the actual economical value of this prodigious range of auriferous deposits, which has been shown to extend so widely over the Indian peninsula, little or nothing is, I believe, known. There is, however, the simple fact before us that in many places they have been worked by the natives, who must therefore have been able at least to obtain a subsistence from their labours, although carried on, we know, in the rudest and most simple manner. When however, I consider the extreme poverty of the auriferous deposits, which by skilful and scientific management are profitably worked in Europe, and further take into account the very low price of labour in this country, I am firmly impressed with the conviction, looking at the subject in a practical point of view, that the application of the same means might in this country be made to produce an equally beneficial result. Although there is no reason to believe that our gold-washings generally, are rich enough to attract or to recompense individual enterprise, it is highly probable that in such a vast extent of country there may be some much richer than others. It is also probable, if not indeed certain, that there are many which might be made the means of affording a beneficial occupation to a large number of labourers, of contributing to the revenue of the state, and of forming in their aggregate results, a valuable addition to the metallic circulation of the country.

Should the experiment in question succeed, the benefits derivable from it, might, as I have shown, be very great; it would induce a more careful examination of numerous and widely spread auriferous deposits, a far more economical treatment of their produce, and very possibly the discovery of veins, or of limited tracts much richer than any hitherto made known by the casual discoveries of the natives. Even should the experiment fail, which is very unlikely, the expense might be limited from the first to a very moderate amount, while other indirect advantages, arising from an increased attention to the mineral capabilities of the country, might be confidently reckoned upon.

Supposing the auriferous deposits of India to attract the attention of Government, the plan which I should propose to follow, would be to obtain the services of some competent person, practically acquainted with the treatment of auriferous sands in Brazil, or with the reduction of gold ores, as practised in the Austrian mines. Perhaps a mining Engineer might be found, uniting both these qualifications. A careful examination of some of our auriferous sands, say those on the Malabar Coast, which evidently extend over several hundred square miles, would soon show where were the richest spots, and where the reduction works might be established with the greatest probability of success. The requisite apparatus need by no means be costly: it should embrace, besides minor articles commonly used in the washing and separation of gold, the amalgamation machinery, employed so successfully in the reduction of the poor quartzose ores of the Tyrol, and one or more furnaces to attempt the fusion of the auriferous sands, according to the plan successfully introduced in Russia about three years ago in the gold works of the Ural mountains. The sands or other ores of gold might be bought of the natives, at a fixed valuation, according to the per centage of the precious metal which they were ultimately found to contain, a certain amount being paid to the contractors previous to their delivery. Were this species of industry to become thoroughly established in certain districts, as after a time it no doubt would do, the gold dust might form a useful medium of exchange, and be received by Government as "kist," which alone would give a powerful stimulus to production. Whether it would be most desirable for the mining Engineer appointed to the charge of the reduction works, to receive the auriferous sands from the gold washers in its first crude state, as originally collected by them, or whether it should first undergo some preliminary washing and concentration, is a consideration of some importance which could only be determined by experience.

In concluding this notice, I shall briefly draw attention to a subject which is too technical to be generally understood, although interesting in itself, and of primary importance as connected with the preceding suggestions. I allude to the actual produce, or *per centage* of gold, which can be profitably extracted from the ores or sands containing this metal, by the most economical and improved methods now practised in the gold mine districts of Europe and Brazil. From the data I shall now adduce it could easily be ascertained by a little chemical and mineralogical research, how far the auriferous deposits of India are likely to repay the improved system of realizing their produce, which I have now suggested. In fact from the very low priee of labour in this country, there can be no doubt that ores of the same produce might be made to yield a much larger profit than in Europe, for in the *price* or *value* of the metals (gold and silver equally with any others), the actual labour expended in their production, forms by far the most considerable item.

It may be laid down as a general truth in mining, that, with very rare exceptions indeed, the ores of the precious metals are exceedingly poor, and that the metallic particles to be collected, bear but a very trivial proportion to the mass of worthless matter, throughout which nature has disseminated them. Thus in the silver mines both of Europe and America, the average produce of the bulk of ores extracted, does not exceed more than from 3 to 4 or 5 ounces in 100 pounds weight, or one pound of metal in 400 pounds of the ore. Yet silver ores of this low produce are in numerous instances profitably extracted from deep mines, where they have to be raised even three, four, or five hundred yards to the surface, where powder is required for blasting the rock, water wheels, steam engines, or other expensive machinery for draining off the water, and where the price of labour is six, eight, or even ten times as great as it is in India. It is true that in these mines richer ores are also found, but they are in comparatively small proportion, fluctuating in their quantity and quality, and not to be depended on for profitable returns.

The value of gold being fifteen times greater than that of silver, it will readily be conceived that very minute quantities of this precious metal will pay for the expenses of extraction. In point of fact the poverty of some auriferous deposits is almost inconceivable, indeed it often happens that the particles of the precious metal are so very minute, and so sparingly scattered through the mass, that the naked eye is totally unable to detect them, and except by the careful mineralogist, the whole would be looked upon as mere worthless matter, and entirely rejected. Of this general poverty of gold ores, I shall now adduce a few striking examples, taken it will be observed from widely distant localities.

At Zelle in the Tyrol, a mineral district, situated a few leagues from Inspruck, the gold ores, or rather the auriferous mass extracted from the mines, yields on an average from five to seven ounces of the precious metal in 1,000 cwts. Now this amounts to only one pound of gold, in from two to three hundred thousand pounds of refuse, yet even from this exceedingly poor ore, the skill of the German mining Engineers, enables them to extract a small profit. The ore, I may further observe, is a hard quartz, very similar to that which occurs north of the Pennar River, in the Nellore district, and requires to be stamped or finely pulverized, before the gold can be extracted. At the mines of Kremnitz in Hungary, the average produce of the gold ores is only 7 to 8 ounces in the 1000 cwts, or 100,000 lbs, being thus very little higher than in the mines of Zelle.

Let us now turn to Brazil, a country well known for the large supply of gold which its mines annually furnish. The precious metal is here found in veins and worked by mining, but a vast quantity is also disseminated in very minute particles through the sands of certain auriferous districts, exactly as we have it in India. I have been informed by my friend Mr. Attwood, who has been resident for some years in the mineral districts of that country, that a cubic foot of this sand, which may be estimated as weighing about 1 cwt. is considered very profitable if it yields an *oitava*, or about one eighth of an ounce of gold, but that sands are worked which do not afford more than one-tenth of this produce.

In Carolina, in the United States, ores containing more than 1½ ounce per ton, or 1 lb of gold in 23,000 lbs of ore, may for the most part be worked with profit, although disseminated in a hard matrix of quartz which requires to be pulverized by machinery. It is also particularly deserving of remark, that the price of labour in Carolina, like most other parts of the United States, is very high, being a dollar, or two rupees per day.

From a consideration of all the facts which have now been detailed, it appears to me that we may safely arrive at the following conclusions :—

1st.—That there are in India, immense and almost unexplored tracts of auriferous country.

2nd.—That these have here and there been worked by the natives, though doubtless in the most rude and imperfect manner.

3d.—That the reputed poverty of many, may be after all merely relative, when compared with other districts, which by better means are made to yield a profitable return.

4th.—That taking into account the occurrence of the precious metal in India, at the surface of the ground, and the very low price of labour in this country, compared with Europe or America, there is in all probability an ample field for increasing the revenue and benefitting the population, by the extensive introduction of gold washing and amalgamation, upon the same improved and economical system as is practised in the above quarters of the globe.

I shall mention in conclusion, that, by means very similar to what I have now suggested, Russia has within the last few years laid open a new and important source of wealth to the empire. At the commencement of the present century, in fact till within the last few years, the mineral district of the Ural mountains was almost unknown, and only productive to a small extent. Careful examination has, however, shown, that auriferous sands exist in great abundance, and that platinum occurs more sparingly, and considerable attention has of late years been given to the skilful development of these mineral resources. The results of these exertions have been most encouraging—this district now yields annually more than 12,000 lbs. of gold, and a small proportion of platinum, producing altogether the annual sum of £800,000 sterling to the government. A large proportion of the gold of the Ural is produced from exceedingly poor auriferous sands, like those of India; and it has lately been found practicable to separate the gold by *fusion*, more cheaply than by the ordinary process of amalgamation by quicksilver. The economy of this expensive article in the reduction of the poorer ores of gold, is of course an important consideration.

With reference to this last operation—the extraction of the precious metal from its extraneous concomitants—it is deserving of remark, that a very interesting discovery has been made within the last year or two by M. Becquerel, the distinguished French chemist. It has been discovered by this philosopher that the electro-chemical agency may be employed in the reduction of the ores of the precious metals, as a substitute for the ordinary process of fusion or amalgamation; and it is highly probable that by this important invention this operation may shortly be economized, to an extent hitherto unattainable. In this case it will allow of the profitable working of auriferous sands, and ores, even poorer than any which have been described in this paper. It is not improbable, therefore, that this refined and important discovery, may constitute an entirely new era in the history and production of the precious metals.

IV.—*Observations on the Fossiliferous beds near Pondicherry, and in the district of South Arcot.*—*By* C. T. Kaye, Esq. *Madras Civil Service.*

The existence of a bed of fossiliferous limestone in the neghbourhood of Pondicherry has long been pretty generally known to those who take an interest in such subjects, and some attention was recently attracted to it by several communications in the *Spectator* Newspaper. An observant person, indeed, can hardly fail of being struck with the nature of the stones which form the paving of some of the streets and the steps of many of the houses in Pondicherry, and which are replete, not only with the fragments of innumerable shells, but with many ostreas and other bivalves almost as entire as if they still reposed in their proper element. The silicified wood at Trivacary is also well known to the public from the beautiful polish which it receives, and from its adaptation to table and other ornaments. To the geologist it is interesting from the vast size of the petrified trees (one of which is nearly 100 feet long), from their great number, and from the perfect state in which these organic remains of other worlds are preserved.

It had long been a desideratum to collect data on which the era and nature of the formations which contain the fossils might be decided, and I accordingly took an opportunity of leisure in October last, to proceed to the spot with Mr. Cunliffe of the Civil Service. The time which we were enabled to devote to the investigation was unfortunately short, and it might certainly have been committed to more scientific and experienced hands. I trust, however, that the facts which we were fortunate enough to collect were not altogether unimportant, and that, imperfect as our researches must necessarily have been, they may pave the way to more interesting discoveries.

Before proceeding further, I may as well mention, that, although the geology of India has generally been considered uninteresting on account of the absence of fossiliferous strata, Pondicherry is not the only locality in the south of the peninsula, where fossils are to be met with in abundance. In the inland district of Trichinopoly marine shells are also found imbedded in limestone, and the kindness of Mr. Onslow has put me in possession of several interesting specimens, of which notice will be taken hereafter.

The village of Seedrapett, the site of the shell limestone which is the subject of the present notice, is seven miles west of Pondicherry, and Trivacary is about eight miles to the west of Seedrapett. The form of the country may be characterized as an undulating plain: the limestone formation is flanked both on the east and west by one of the red sandy soil, which on the one side forms the low mounds of Trivacary, and on the other the "Red Hills" of Pondicherry, the latter being perhaps a continuation of the same formation which contains the silicified wood. If this be the case, it is evident that the limestone rests upon a basin or depression of the red sand, but owing to the absence of sections, and the imperfect means we had of ascertaining the position of the strata, this fact is by no means laid down as established, but is merely suggested as a point for future investigation.

The petrifactions of Trivacary have been often described, especially of late, it is only necessary therefore to state that they consist of numerous silicified trees, some of them of vast dimensions, resting more or less buried on low bare hills of a friable red sandstone. The hills are grouped in a circular form, and the petrifactions in many instances retain a perfect resemblance to the trunks of fallen trees. The red hills are bounded by others of a dark granite: the line of demarcation being very distinct. The trees, however, are not found reposing on the hillocks at Trivacary alone, but we observed them at a distance of at least three miles from that place, imbedded in the red sand, on the road to Seedrapett. We were totally unable to discover any other fossil, or any indication of such a thing, in the red soil which so abounds with the silicified wood.

There is a gradual descent from Trivacary towards Seedrapett, and the limestone commences immediately on the boundaries of the red soil;

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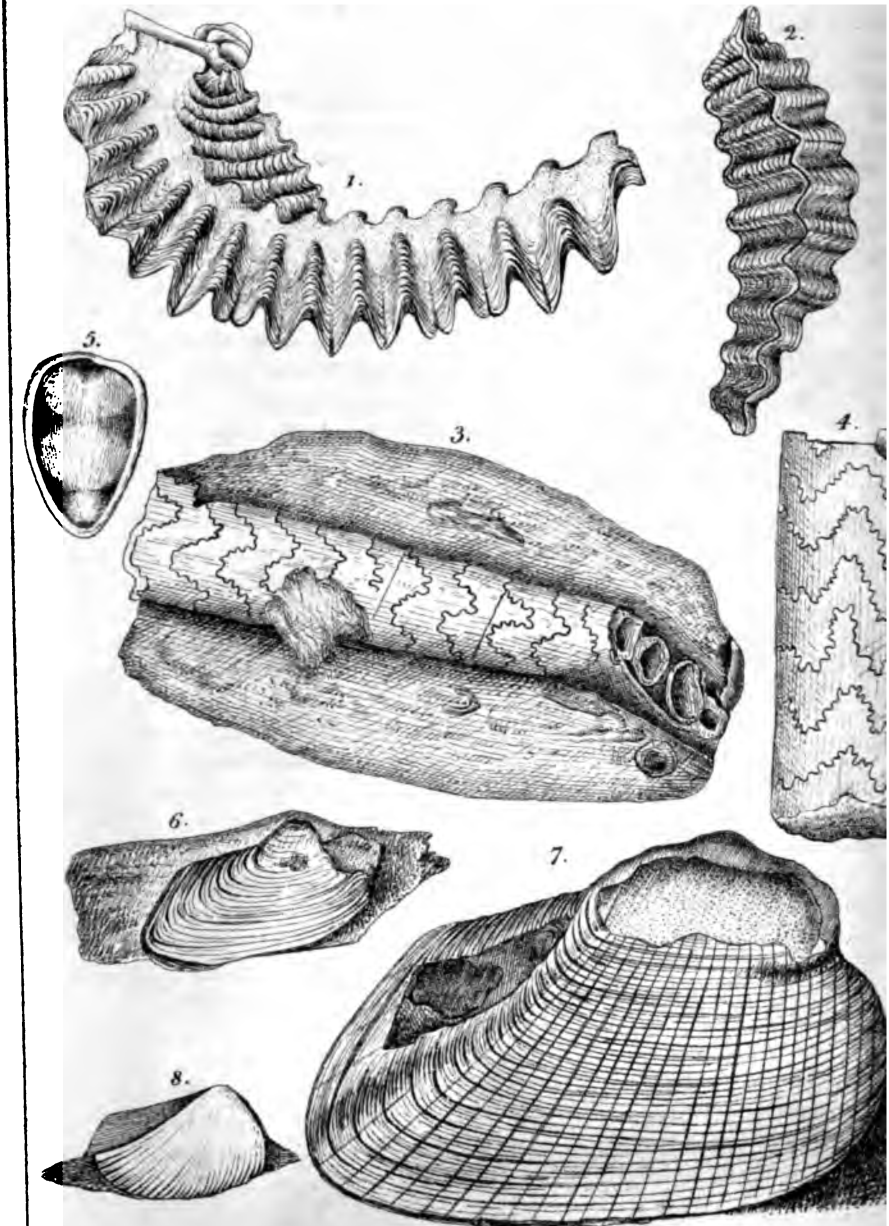

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it presents, as has been already stated, an undulating wavy surface, and the stone is found immediately below the turf, and sometimes even appears above it: it is quite hard, and is quarried in large blocks, though to no great depth, for the purposes before mentioned. It is almost every where replete with shells or other organic remains, which are in general so firmly imbedded in the hard stone that it is impossible to detach them: the geologist, therefore, who would study with accuracy the nature of this deposit, should endeavour to reside for some period on the spot, many of the shells which are most perfect in the stone, not having yet been discovered in a separate state. In one situation, however, there are several small mounds of a whitish limestone, almost resembling chalk, where the surface having been abraded and decomposed by water, the shells which it contained have been separated, and lie scattered on the surface of the soil, among the debris of the containing rock: it was in this spot that most of the specimens here noticed were collected. I will now proceed to describe them in the order in which they appear in the Plates.

Pl. I. Nos. 1 and 2—*Ostrea carinata*—The identity of this shell with that figured by Lyell and other authors among the fossils of the European chalk cannot be doubted: they are very numerous at Secdrapett, and are found both in a separate state and imbedded in the rock, sometimes very perfect. No. 1 is slightly fractured at the point, but the linear marking, and even the sharp angles of the ribbing on the sides, are beautifully preserved, and the inner surface retains much of its polished enamel. No. 2 is a perfect specimen of the two valves adhering firmly together.

Nos. 3 and 4 are *Baculites*. This shell is called by Dr. Buckland a straight ammonite, and the same authority states that it is " found in the cretaceous formation alone." We collected many fragments of this shell on the surface of the soil, varying from three inches to half an inch in length: the most perfect specimen being imbedded in a rolled piece of limestone (No. 3), and owing to a longitudinal fracture displaying four of its chambers. All the specimens display the foliated markings at the junction of the walls of the chamber with the external shell: they are of a yellowish or reddish brown colour, and the interior is generally filled with beautifully crystallized calcareous spar. No. 5 is the transverse section of a baculite.

Nos. 6, 7, 8 are bivalve shells, probably referrible to the genus Cardium; they are represented about the natural size; 6 and 7 retain the shell itself and appear almost recent, but the interior of No. 7 is filled with the limestone and fragments of shells cemented together sufficiently hard to take a polish. In No. 8 the shell itself has disappeared and left merely a cast in whitish limestone

Plate II. Nos. 1 and 2 are *Echini*, of the order *Spatangus*, common in the chalk of England. No. 2 is a small but perfect specimen. No. 1 is a portion of the external shell flattened out on the stone.

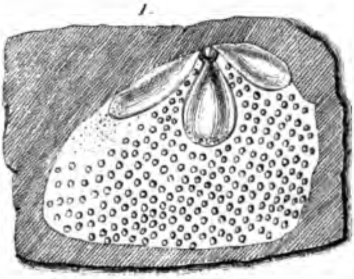
No. 3.—This is apparently the apex of a *Turbinolia:* it is not unfrequent in the limestone, and was sometimes found detached, in which case it precisely resembles the drawings of the *Turbinolia* given by Dr. Mantell, in his Geology of the South-east of Sussex, but is apparently of a larger species.

Nos. 4, 5, 6, 7, 8 are fragments of a zoophyte or coral with a pyriform body or termination, which is always found detached (No. 4); other fragments are cylindrical. This zoophyte seems to have consisted of numerous small lamellæ, converging *towards* the centre: but there was probably a cavity *in* the centre, which is now filled up with the chalky substance, as the lamellæ do not unite at the axis. No 6 shows the radiated appearance presented by the transverse section of a cylindrical joint or fragment, and 7 and 8 display the internal structure where it is laid bare by the decomposition of the external covering. These fragments are probably the joints of the stem or branches of the zoophyte, which may possibly therefore, have been the *Apiocrinites ellipticus*, but until more perfect specimens are found it cannot be named with any degree of certainty. The component matter of this fossil is carbonate of lime, and it effervesces freely with acid. They are found in great numbers close to the village of Seedrapett. We collected upwards of an hundred in about half an hour, and one of the best specimens I took out of the wall of a mud house.

No. 9 is a small mass of limestone, displaying on both sides beautiful sections of a multilocular shell, which Mr. Burr informs me is a *Turrilite.*

No. 10. A great number of small cylindrical bodies of this description were found, the longest perhaps 1½ inch in length, and about the thickness of a tobacco-pipe: they all have a longitudinal groove or sulcus, whence it may be inferred that they are a species of *Belemnite*, perhaps *B. minimus;* but it must be mentioned that, among the hundreds that were collected, and the still more numerous specimens that were thrown aside, not one was found which came to a point. Further research may, perhaps, supply this deficiency.

No. 11. Several casts of a slightly curved chambered shell, with annular markings, probably referrible to order of *Hamite* were found.



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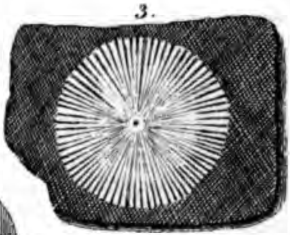

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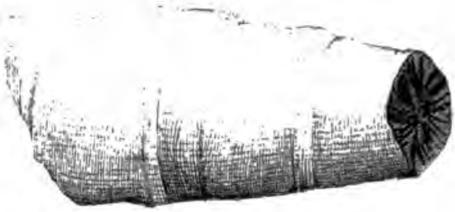

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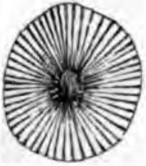

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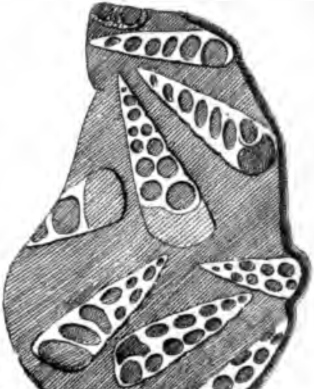

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10.

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12.

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The drawing represents the chamber as seen in the section, but the radiated marking is probably owing to crystallization.

No. 12 is a cast in limestone of a bivalve shell.

It is no easy thing to name fossils even to those who are most accustomed to geological researches, this department forming in general a separate branch of the science: many of the fossils, however, described in the above lines are of so marked a character, that in those instances where we have ventured to name them with any degree of certainty, we can hardly have been mistaken. I have not neglected either to consult those who were best able to give an opinion on the subject, and have also carefully compared the specimens with the best drawings and authorities I could meet with. To Mr. Frederick Burr, I am particularly indebted for the valuable assistance and information he has afforded me. If we do not err therefore very widely from the mark, we have, even on the information already obtained, very good *primâ facie* evidence that the Pondicherry beds are the equivalents of the upper secondary formations of Europe, and the fossils point especially to those of the chalk and greensand.

It is a well known fact that, during the formation of the cretaceous beds in England, a great quantity of silex held in solution by water must have been poured out; which, by the process of chemical affinity having collected around various organic nuclei such as corals, sponges and other zoophytes, has formed continuous and extensive layers of flint, interstratified with the chalk, almost every nodule of which contains and derives its shape from the enclosed remains of some organized body in a state of complete petrifaction. We observed no vestige of flints in the limestone at Seedrapett, and all the fossils collected there consist of carbonate of lime, and effervesce freely with acid; but the vast quantity of silicified wood, in the neighbouring formation of red sand, seems to point to some phenomenon similar to what must have existed during the deposition of the cretaceous beds of Europe.*

Lieut. Newbold, in the last number of the Journal; suggested that the fossiliferous beds of Pondicherry probably extended into the Verdachellum talook of South Arcot. I have made enquiries but have not yet obtained any evidence of this fact. Another interesting question, however, now suggests itself, viz, is the shell limestone at Seedrapett analogous and contemporaneous with that already mentioned as containing fossils in the Trichinopoly district? Sufficient data have not yet been collected to enable one to give a positive reply to this enquiry. The specimens which I have received from Trichinopoly consist of masses of limestone, very similar in character to that of Seedrapett, and containing innumerable small shells cemented together in the hard rock. Shells are, however, found detached from the stone, in general I should say in a more perfect state than those at Seedrapett.

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* "Flints so commonly enclose the remains of sponges, alcyonia and other zoophytes, that some geologists are of opinion that the nucleus of every nodule was originally an organic body: that this has been the case in most instances is very evident: and in Sussex there are but few flints that do not possess traces of zoophytical organization."

Mantell's Geology of Sussex, 144.

Pl. III. No. 1, is a large bivalve from Trichinopoly: of which the shell is entire, with the exception of being chipped at the edges: it is filled with limestone.

Nos. 2 and 3 are intended to shew the nature of the shells contained in two small masses of the stone: the most perfect shells have been chosen for representation, but it was found impossible to figure the innumerable small shells and fragments of which the mass almost entirely consists. The shells in No. 2 are small turrilites, evidently of the same species as those represented in Pl. II. No. 9. Several specimens from the same locality, in Dr. Cole's possession, appear to me also to be turrilites, a fact which leads us to infer some analogy between the two formations, which further research will probably tend to demonstrate.

An interesting fossil from Trichinopoly in my possession is a piece of calcareous fossil wood, containing a number of petrified Teredines in crystallized carbonate of lime.

There can be no doubt that our knowledge of these beds is still very imperfect, and it may be supposed that it would have been better to have deferred the present notice until more accurate information should be obtained; but a temporary residence in Madras gave me an opportunity of consulting works to which I might not otherwise have had access, and also afforded facilities for getting up the drawings, &c. connected with the publication, which I was the more unwilling to neglect, as they might not speedily recur.

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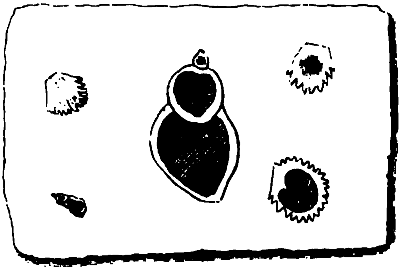

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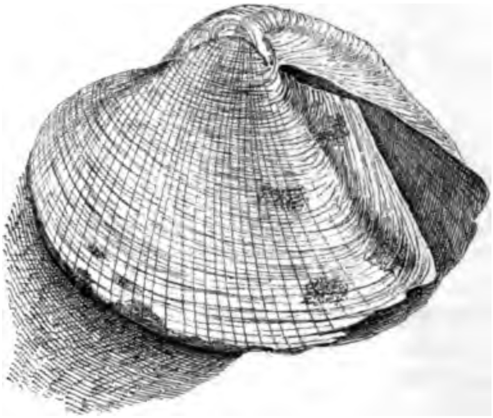

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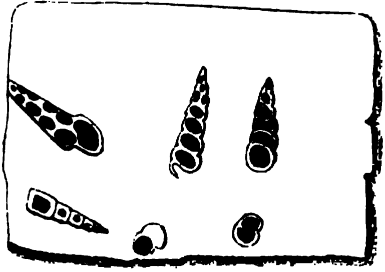

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V.—*Remarks on the Fruit of the Natural Order Cucurbitaceæ.—By* ROBERT WIGHT, M. D., F. L. S. &c.

The order *Cucurbitaceæ*, is perhaps one of the most curious and inexplicable in the system of plants, and though at different times much studied by several eminent botanists, is still imperfectly understood; at least if we may judge from the fact, that no two writers on the distribution of plants according to their natural affinities seem to agree as to what families are its nearest allies. It is not now my intention to examine this question, for which, indeed, I have not at present leisure, even supposing I possessed the requisite materials, which I do not, but merely to offer a few observations on the general character of the family and fruit, introductory to a conspectus of the genera of the order, with which Dr. Arnott kindly favoured me, and at the same time permitted me to place on the pages of the Society's Journal, should I deem that desirable. Deeming the conspectus really a most desirable addition to our Indian botanical literature, I have much pleasure in submitting it for that purpose, in the hope that the Society may be of the same opinion.

The *Cucurbitaceæ* are a tribe of plants so very unlike the rest of the vegetable kingdom, that I think I may safely say no one having the slightest knowledge of family likeness among plants, could ever mistake so far as to refer one of them to any other family. Though thus isolated from all around, and without a single near relation with whom they can be justly compared or confounded, they yet stretch their more remote affinities on all sides; hence the difficulties which systematic writers find in decisively referring them to any one place, more than another, in the series of orders. Nearly all however, now agree in placing them among orders having parietal placentæ, that is, among plants the ovary of which is one-celled.

To any one who will take the trouble to look attentively at a slice of a young cucumber this must appear strange, but is yet not the less true. In one of the latest and the best introductions to botany in the English language, Dr. Lindley's, a peponida, the peculiar fruit of the order, is thus defined :—" One-celled, many-seeded, inferior, indehiscent, fleshy ; the seeds attached to parietal pulpy placentæ. This fruit has its cavity frequently filled at maturity with pulp, in which the seeds are imbedded; their point of attachment is, however, never lost. The cavity is also occasionally divided by projections of the placentæ into spurious cells, which has given rise to the belief that in *Pepo Macrocarpus* there is a central cell, which is not only untrue but impossible."

Dr. Arnott in the article Botany, Encyclop. Brit. Ed. 7, gives a different account of it, but still, it appears to me, far from a correct one, namely:—" A *pepo* or *peponida* is a fleshy inferior fruit, either indehiscent or bursting irregularly, and consisting of about three carpels, each of which is divided into two cells by its placentiferous margin, being so introflexed as to reach the dorsal suture. The sides of the carpel, and even sometimes the introflexed portion, usually become extremely thick and fleshy, forming the great mass of the ripe fruit, so that by losing the general character of dissepiments, they might almost be said to disappear, and thus at first sight a pepo would be said to be, and has been so described, a 1-celled, fleshy, indehiscent fruit, with parietal placentas, that send out sometimes false dissepiments towards the axis, as the cucumber and gourd."

This view, therefore, is essentially different from Dr. Lindley's, for, according to Arnott the placentæ are virtually central, not parietal. The only difference between a pepo and an apple being, according to him, that the placentiferous margins of the carpellary leaf are introflexed, and extend outwards nearly to the parietes of the fruit, in place of remaining in the axis. Lindley on the other hand views a pepo simply as a one-celled fruit with parietal placentæ, the cavity being occasionally divided into spurious cells by projections of the placentæ. Neither are altogether consonant with appearances, though that of Arnott appears the most so; but both, in common with all others that have yet been promulgated, are incorrect both as to theory and fact.

While our ideas of the structure of the most essential organ of the plant, with reference to natural affinities, are thus vague, can it be matter of surprise that we are unable to trace its relations, and determine its affinities in the system of plants ?

What then is a peponida ? I have said above that it is neither a one-celled fruit with parietal placentas, nor a three-celled one with introflexed central placentas. But before I can say what it is, and point out the difference between it and a fruit of the usual construction, it is necessary to state what the usual structure is. This I shall do by means of a short extract from Lindley's Key to Structural Botany.

354. " A Carpel is formed by a folded leaf, the upper surface of which is turned inwards, the lower outwards ; and the margins of which develope one or a greater number of buds, which are the ovules.

355. When the carpels are stalked, they are said to be seated upon a *thecaphore*, or *gynophore ; Ex.* Cleome, Passiflora. Their stalk is analogous to the petiole of a leaf.

355. *a.* When the carpels are all distinct, or are separable with facility, they are *apocarpous*; when they all grow into a solid body, which cannot be separated into its constituent parts, they are *syncarpous.*

356. The ovary is the lamina of the leaf.

357. The style is an elongation of the midrib (174)

358. The stigma is the denuded, secreting, humid apex of the midrib.

359. Where the margins of the folded leaf, out of which the carpel is formed, meet and unite, a copious development of cellular tissue takes place, forming what is called the *placenta.*

360. Every placenta is therefore composed of two parts, one of which belongs to one margin of the carpel, and one to the other.

361. As the carpels are modified leaves, they necessarily obey the laws of arrangement of leaves, and are therefore developed round a common axis.

362. And as they are leaves folded inwards, their margins are necessarily turned towards the axis. The placentæ, therefore, being formed by the union of those margins, will be invariably next the axis."

From this we learn, in few words, that the carpellary leaf is always so folded that its midrib is towards the circumference, or forms the dorsum of the cell or carpel, while the placentiferous margins are placed in the axis; that the difference between a one-celled and many-celled fruit, merely consists in the placentiferous margins of the carpellary leaves of the former not extending inwards to the axis, but stopping in the circumference and bearing their ovules attached to the walls of the cell—hence *parietal.* This position of the carpellary leaf is so constant, that the possibility of an inversion of this order of things in a pepo seems never to have entered into the calculations of any one of the numerous botanists who have given their attention to the investigation of the structure of this curious fruit; and yet such is simply the case. In a pepo the normal position of the midrib of the carpellary leaf is reversed, that is, is placed in the axis, and the placentiferous margins towards the circumference. That such is actually the case requires no argument to prove; we have only to cut the ovary of any true cucurbitaceous plant to be made sensible, at a glance, that it is so: though I confess that in none have I seen it so clearly made out as in *Coccinia Indica*, owing to the carpels of that species remaining distinct, merely held together, not as usual by cohesion between the respective carpels, but by the tube of the calyx in which they are enclosed. Did I wish to illustrate the theory by means of a diagram, I could not devise one more perfect than a simple section of the ovary of that plant, merely extending the natural divisions, by dividing the calyx, so as to allow each of the carpels to be slightly separated in the representation, to facilitate the demonstration. This, however, is I think even unnecessary, for with the clue to the true structure, which this species furnishes, there can no longer be any difficulty in understanding it from the examination of any genuine species of the order.*

What effect this new exposition of the structure of the ovarium may have on the determination of the affinities of this order, I am, up to the present time, quite unprepared to say: but of this I feel certain, that, in so far as structure is concerned, they are as far removed from all their now reputed allies, as their peculiar habit removes them from all the parietose families, except *Passifloræ*, among which Bartling, Endlicher and Lindley have placed them. This very unusual structure, in short, marks them as a peculiar order, the affinities of which have still to be sought for.

I am equally unprepared to say to what extent this unlooked-for structure may influence our views in regard to other anomalous orders, especially those with solitary carpels: since, having established the fact that the usual structure may be inverted, it will naturally lead to new investigations, which may prove, that the solitary carpels of *Leguminosæ* are not, as now supposed, necessarily the result of constant abortion of one of two carpella, but may be explained on some other theory more consonant with the, almost invariably observed, structure in that large and interesting order; which, like *Cucurbitaceæ*, stands an isolated family in the system of plants, through this one remarkable peculiarity,—a peculiarity so constant, in this tribe, that it goes far to prove the existence of that botanical nonentity, a terminal leaf. But, being unprepared to offer any matured opinions on these points, I forbear further speculation, and shall at once proceed with the conspectus; trusting, however, ere long, to be able to re-enter more at large on the consideration of this interesting enquiry.

The subjoined remarks, I copy from the article *Cucurbitaceæ* in my forthcoming Number of the Illustrations of Indian Botany.

" The following explanatory extracts from the letter which accompanied the Conspectus, may not inappropriately be introduced.

" ' I have lately been revising our East Indian *Cucurbitaceæ*, in consequence of Schrader's paper in the Linnæa, vol. 12. At first I was inclined to consider it worse than useless to subdivide old genera, especially *Bryonia*, as he has done; but when I came to consider his sectional characters, and that the form and position of the stamens and anthers and stigma and fruit are, really, the only characters hitherto employed for genera by other botanists; and that all Schrader has done, is to keep only those species in their old genera that agree with the character and turning out, and making new genera of those that do not, then I felt inclined to go great lengths towards adopting his views. I intend here to give you a Conspectus, or abridged generic characters, which I have drawn up, not only for the Indian, but also for the whole world, which I shall not object to your publishing as " abridged characters of the genera of the tribe *Cucurbiteæ* of Schrader.'

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* After this paper was in the printer's hands it was suggested that some illustrations were desirable to render the verbal description more easily understood. The accompanying figures representing the three different forms of ovaries—1-celled with parietal placentæ; several celled with central placentæ; and a Peponida; were therefore prepared,

" At the conclusion of the conspectus he continues,—' These seem to be all the genera known that truly belong to *Cucurbiteæ*, they have all unisexual flowers. *Gronovia* has them bisexual, but is otherwise very closely allied. *Allasia* cannot be of this order, unless we suppose the description quite erroneous; and if so, Loureiro may have had before him, in part at least, the *Telfairia pedata*; *Myrianthus* cannot belong to *Cucurbitaceæ*.

" ' *Thladianthus Runge* is imperfectly described as to the stamens, but may perhaps form a 7th tribe.

" ' I have laboured under great difficulty in making out these characters, partly because the published descriptions were very imperfect, partly because I had not several of the genera, and partly, from the extreme difficulty of examining the anthers after being dried and pressed. I would therefore suggest to you and other Indian botanists, to re-examine all the Indian ones on living plants, and have drawings made, paying particular attention to the representation of the anthers.

" ' At first you may, as I did, confuse section 7 with section 9, but if you will compare the flower of *Citrullies*, *Momordica* or *Lagenarea* with *Cucurbita* or *Coccinia*, you will readily see the difference. In section 7, the connectivum is lobed, and the anther cells are placed along the edge of the lobes—in sections 8 and 9 the connectivum is not itself lobed, but the anther cell is bent,' (it winds upwards and downwards along the back of the connectivum).

" Warned by the concluding paragraph of the difficulty attending the description of these plants from dried specimens, I took occasion, as opportunity offered, to compare some of the sectional characters with recent specimens, and feel disposed to think the sections too numerous, and not sufficiently distinguished. I have not yet succeeded in comparing the whole, but would suggest the following alterations, which I think would improve the arrangement.

" Section 6 might with advantage be suppressed, and its only genus referred to section 5. Sections 7 and 9 would be better united, the anthers being the same in both; transferring, however, *Cucurbita* to section 8, on account of the anthers, which are similar to those of *Trichosanthes*, making the insertion of the filaments a matter of secondary consideration, a generic not a sectional distinction.

" The difference between sections 7 and 8 would then be—not that in the former the anther is lobed and in the other entire, but that in section 7 the back is traversed by an elevated gyrose ridge, on the top of which the long gyrose anther is placed, while in section 8 there is no such elevation, the anther cell being sunk into the substance of the connectivum, not elevated on a ridge with a deep furrow between each bend. To this may be added that the connectiva in section 8 is elongated ; hence, from the union of the three, a cylinder results, while in the other their union produces a sort of capitulum.

" *Bryonia Garcini*, doubtfully referred to *Bryonia*, is a new species of *Pylegyne : Bryonia leiosperma*, I find, from the examination of dried specimens, is a second species of *Mukia*, with which it agrees well in habit.

" Notwithstanding these differences of opinion, it is not my intention to alter the conspectus, but print it simply as it reached me, the few additions I have to make, being included within brackets—thus [ ]. Before proceeding further it may be well to explain what is meant by the term tri-adelphous, as applied to this family, which is of such frequent occurrence in the following characters. The normal structure of *Cucurbitaceæ* is to have five stamens, in place of which we usually find only three ; but when these are carefully examined it appears that two of them are twice the size of the third, and are actually made up of two united : each set is then called an adelphi or brotherhood, and the three together tri-adelphous This structure is readily seen in the *Pekunkei* (*Cucumis acutangulus*, Ainsley) where the anthers do not cohere. In those where they do cohere it is not so clearly seen, as they then require to be separated artificially before it can be made out.

" In some genera the anthers are described as being one or two-celled ; these characters require to be used with caution, as being generally of very difficult application in practice. Theoretically every anther is two-celled, and here in examining a number of instances with particular care, under a high magnifier, I have found most of them actually two-celled, though on less careful examination they appeared only one-celled. If such is the case when examined with fresh specimens, how much more liable to error must we be when working with dried ones.

CONSPECTUS OR ABRIDGED CHARACTERS OF THE GENERA OF THE TRIBE CUCURBITEÆ[*] OF SCHRADER.

§ 1.—*Filaments 5, inserted on the throat of the corolla; anthers distinct or 3-adelphous, anticous, straight; fruit baccate, few seeded.*

1 Coniandra (Schrad.). Corolla 5-partite: connectiva conniving, oblong, conical: fruit beaked. *South Africa.*

2 Cyrtonema (Schrad.). Limb of corolla 5-partite: filaments 5, incurved, connectiva incrassated 3-adelphous; anthers fixed laterally under the apex. *South Africa.*

§ 2.—*Filaments di or tri-adelphous, inserted on the tube of the corolla; anthers lateral, straight, 2-3-adelphous.*

3 Sicydium (Schlecht). Corolla 5-petaled, petals undivided: filaments 3-adelphous, dilated and incurved at the apex; anthers without a beak. *Mexico.*

4 Bryonopsis (Arn.). Corolla 5-partite, lobes obovate, entire, undulated: filaments 3-adelphous, inserted on the throat, straight; anthers pointless: stigma fringed: berry few seeded. *East Indies—Courtallum.*

5 Achmandra (Arn.). Lobes of the corolla undivided: filaments tri-adelphous very short; anthers anticous, inserted along the margins of the connectivum, linear oblong; connectivum prolonged into a short beak beyond the anther: fruit baccate (always?) beaked. *East Indies. Bryonia epigæa, rostrata, deltoidea, and an undescribed species from Malabar.*

Obs.—Perhaps this and the two last genera might be joined to Melothria.

6 Melothria (Linn.). Lobes of the corolla undivided, denticulated: filaments 3-adelphous; connectivum pointless: fruit baccate, not beaked. *America.*

Obs.—Schrader notices an East Indian one, but that may perhaps be an *Achmandra.*

7 Ceratosanthes (Schrad.). Lobes of the corolla linear bifid: filaments 3-adelphous. *America.*

8 Anguria (Linn.). Lobes of the corolla entire: stamens diadelphous: fruit somewhat 4-angled. *America.*

§ 3.—*Filaments 3-adelphous inserted on the top of the tube, anthers all*

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[*] This tribe contains all the East Indian genera except *Zanonia*—Schrader refers *Erythropalum* of Blume to Cucurbiteæ but that genus is very closely allied to *Mackaya* (Arnott in Jardine's Mag. of Zool. and Bot. vol. 2) and does not belong to the order.

cohering by means of their connectiva, and applied at the back along the margins of the connectiva sigmoid. (?) two-celled.

9 SCHIZOSTIGMA (Arn.). Style simple, stigma, peltate, fleshy, cleft into 10-12 radiating linear lobes. *Andes of Mendosa.* (*Cucurbita asperata.* Gill.)

§ 4.—*Filaments distinct or tri-adelphous, inserted on the throat of the corolla, anthers 6 or 3-adelphous, gyrose, anticous.*

10 SPHENANTHE (Schrad.). *Mexico.*

§ 5.—*Filaments tri-adelphous, inserted at the base of the corolla, anthers lateral, straight, 3-adelphous.*

11 PILOGYNE (Schrad.). Calyx campanulate; segments of the corolla patent, much longer than the calyx: anthers one-celled: style entire; stigma 1, pileate: fruit baccate, few seeded, obtuse. *South Africa.* [*East Indies—Bryonia Garcini ?*]

12 ZEHNERIA (Endl.?). Lobes of the corolla quite entire: style trifid; stigmas 3, flabelliform, quite entire: fruit baccate, few seeded, blunt. *South Africa, East Indies* and ? *Norfolk Island.—Bryonia Mysorenses. B. Hookeriana.*

Perhaps this is only a subgenus of *Pilogyne.*

13 KARIVIA (Arn.). Calyx urceolate, corolla scarcely exserted, lobes minute, quite entire; anthers two-celled; style entire; stigma pileate, 3-fid: fruit a peponida, many seeded, blunt or with a short thick beak. *East Indies, Bryonia umbellata. B. amplexicaulis.*

14 RHYNCHOCARPA (Schrad.). Lobes of the corolla denticulate, ciliated; style trifid; stigmas 3, jagged and toothed: fruit with a long slender beak. *Guinea.*

§ 6.—*Filaments tri-adelphous, inserted at the base of the corolla, anthers all cohering, posticous, linear, straight.*

15 MUKIA (Arn.). Style entire, stigmas 3, more or less cohering, erect. Anthers distinct, one-celled, lateral; [connectivum prolonged, forming a projecting point: a globose abortive ovary in the bottom of the calyx.] *East Indies – Bryonia scabrella.* [*B. leiosperma.*]

§ 7 —*Filaments 5, or tri-adelphous, inserted at the base of the corolla; connectiva toothed or lobed, anthers applied at the back along the margins of the connectivum, and therefore flexuose, gyrose, or anfractuose.*

16 BRYONIA (Linn.). Corolla 5-cleft: anthers tri-adelphous, one celled: style trifid; stigmas subreniform or bifid: fruit ovoid or globose, baccate; few seeded. *Europe* and *East Indies—B. laciniosa,* India. *B. alba. B. dioica,* Europe. Perhaps also *B. Garcini* and *leiosperma,* but of these I have no male flowers by me to examine [*B. Garcini.* Stamens tri-adelphous one-celled: cells linear, marginal, not sigmoid, anticous: style one,

stigma dilated, peltate: ovary few seeded; pepo inverse reniform, 2 seeded. This is probably a new genus, but if not seems to belong to *Pilogyne* rather than any other here. It cannot possibly belong to *Bryonia.*]

In the European plants, the type of the genus, there are 2 ovules in each of the 3 cells of the ovary – nearly all Blume's species belong to other genera.

17 CITRULLUS (Schrad.). Corolla persistent, 5 parted, subrotate: anthers tri-adelphous, bilocular: style 3-fid; stigma obcordate, convex: fruit a fleshy or dry and fibrous, many seeded peponida. *Africa, East Indies. Cucurbita citrullus* and *Cucumis colocynthis.*

18 ECBALIAM (Rich). Corolla 5 cleft: anthers tri-adelphous: ovules in two rows in each cell; stigmas three, two horned: fruit an elastically and irregularly bursting peponida. *Europe—Momordica elaterium.*

19 MOMORDICA (Linn.). Petals 5, adnate to the base of the calyx, deciduous: anthers all cohering: ovules in a single* row in each cell; stigma two lobed; fruit a capsular, elastically bursting, 3 valved peponida. *E. Indies, South Africa* and *America.*

[*This though practically correct is not theoretically so, the carpellary structure being the same here as in others; each margin has its placenta and ovules: and though at any one section only one row appears, we do not find the ovules always attached to the same line of placenta on slicing the ovary successively from end to end, but sometimes on the one, sometimes on the other side of the cell; such at least I find it in *Momordica Charantia.*]

To this genus seems to belong, *Muricia*, Loureiro and *Neurospermum*, Raf.

20 LUFFA (Cav.). Petals 5, inserted in the base of the calyx, deciduous: anthers all distinct or di-triadelphous: style 3 fid; stigma reniform or bipartite: fruit a peponida, at length dry and internally fibrous, usually opening by a terminal lid, rarely indehiscent. *East Indies* and *Arabia.* There are 3 sections of this genus.

1st. Stamens distinct, *Luffa pentandra, acutangula,* and *Kleinii.*

2d. Stamens 3-adelphous. *L. amara*, Roxb. and nearly all the species of *Turia*, Forsk.

3d. Stamens di-adelphous—*L. tuberosa*, Roxb.

21 BENINCASSA (Sav.). Corolla (yellow), five parted, patent: anthers 3-adelphous: style undivided, very short; stigma large, thick, irregularly lobed and plaited: peponida, fleshy indehiscent. *Asia.*

22 LAGENARIA (Ser.). Corolla (white) five petaled: anthers 3-adelphous: style almost none; stigmas 3, thick and 2-lobed: peponida fleshy and indehiscent. *India, South Africa.*

§ 8.—*Filaments, 3-adelphous, inserted on the tube of the corolla; connectiva entire, anthers 3-or mon-adelphous, posticous, linear, bent upwards and downwards: calyx long, tubular.*

23 Trichosanthes (Linn.). Segments of the corolla lacerated and fringed: anthers 3-adelphous? or all united: style trifid; stigmas oblong, subulate: fruit a peponida, many seeded. *E. Indies.*

[In all the species I have had an opportunity of carefully examining, the anthers are monadelphous or united. The style is not trifid, nor properly speaking the stigmas subulate, as they cohere nearly to the apex by their central face, though the stigmatic surface extends for some distance outwardly, and presents a somewhat subulate outline.]

I reunite *Involucrarea* to this as a mere section depending on the bracteas, the character taken from the anther not holding good, at least *T. Cucumerina* has frequently the anthers all united, and I suspect also *T. Anguina*; perhaps they only become tri-adelphous after fecundating.

[In *T. Anguina* they are never tri-adelphous, the anthers cohere to the last as represented in the accompanying figure. This last species with *T. globosa*, and *trifoliata*, Blume, and *Involucrarea*, Serange (*T. Wallichana*) form a very characteristic section, perhaps a subgenus, distinguished by their curiously bracteated male flowers]. R. W.

24 Gymnopetalum (Arn.). Calyx constricted at the mouth: corolla (yellow) 5 parted; segments quite entire: anthers all closely cohering: fruit baccate, ovate, beaked, few seeded: seeds large, roundish, with a blunt margin *E. Indies.* There are two species—

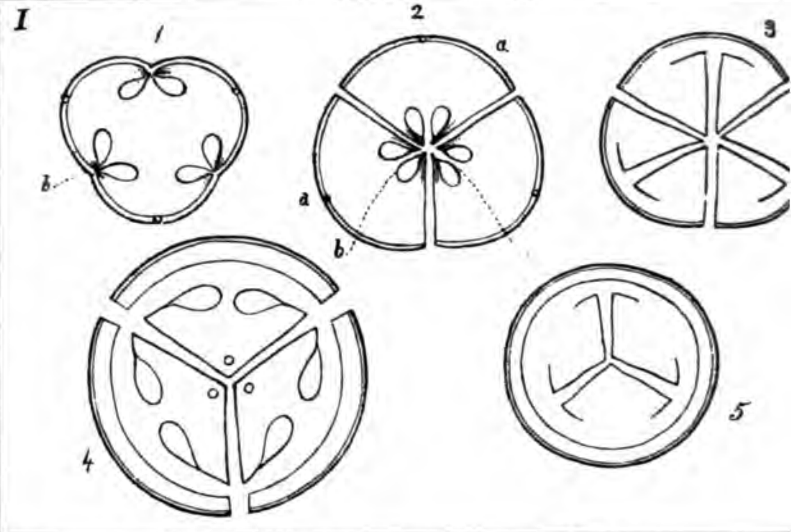
1 *G. Ceylanicum* (Arn). Leaves deeply 5 lobed; perianth glabrous: *Bryonia tubiflora.* W. and A.

2 *G. Wightii* (Arn.). Leaves 3-5-angle-lobed; perianth hairy. *Courtallum.*

§ 9.—*Filaments usually tri-adelphous, inserted at the base of the perianth; connectiva entire, unless when produced into appendages beyond the anthers; anthers linear, posticous, bent upwards and downwards (calyx campanulate or rarely infundibuliform.)*

25 Cucumis (Linn.). Corolla 5-parted: anthers tri-adelphous, or all of them slightly cohering, with appendages at the apex! Peponida fleshy, indehiscent, or rarely irregularly dehiscent, polyspermous: seeds ovate, compressed, sharp edged. *Asia, Africa* and *America.*

26 Cucurbita (Linn.). Corolla campanulate, 5-cleft: filaments tria-delphous at the base or quite monadelphous; anthers all cohering, without appendages: peponida fleshy, indehiscent, polyspermous: seed with a slightly thickened edge. *Asia and America.*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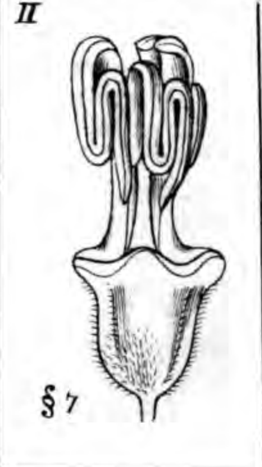
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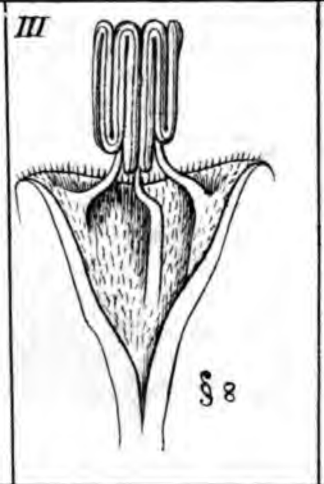
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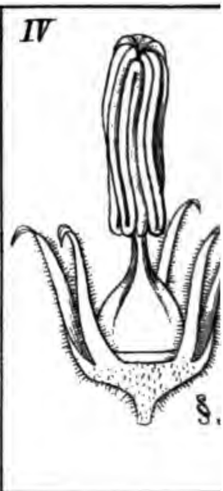
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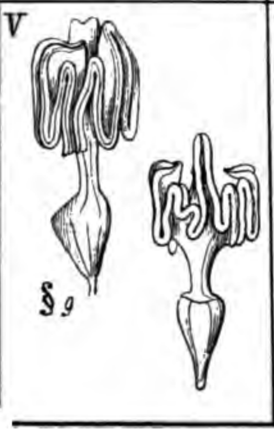
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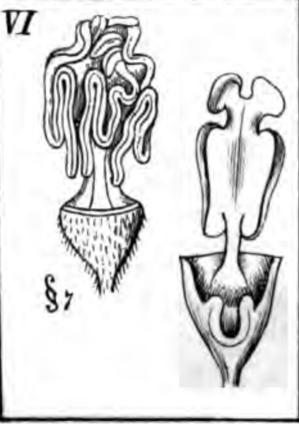
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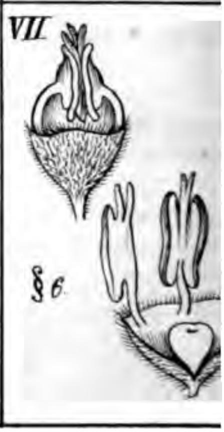
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§ 6

27 ELATERIUM (Linn.). Petals scarcely united at the base: filaments monadelphous, anthers all cohering: style thick; stigma capitate: fruit a coriaceous, one-celled, few seeded capsule, bursting elastically by two or three valves. *America.*

28 SCHIZOCARPUM (Schlch.). Corolla infundibuliform, quite entire; filaments 3-adelphous: anthers all cohering; peponida many seeded, bursting by several valves that cohere by their apex. *Mexico.*

29 COCCINEA (W. and A.). Corolla campanulate, segments acuminated: filaments monadelphous, anthers tri-adelphous, conniving, without appendages: peponida somewhat baccate, many seeded. [Usually of an oblong oval shape and bright red when ripe]. *East Indies.*

§ 10.—*Filaments monadelphous, connate into a column, which is capitate at the apex, and then bearing the gyrose posticous anthers.*

30 CEPHALANDRA (Schrad.). *South Africa.*

EXPLANATION OF THE PLATE.

Fig. I.—1. A tricarpellary one-celled ovary—that is, the placentiferous margins of the carpellary leaves meeting in the circumference, and bearing their ovules on the walls or parietes of the cell.

a Supposed position of the midrib—*b* placentæ parietal.

2. A tricarpellary 3-celled ovary, the laminæ of the carpellary leaves folded inwards, until they meet in the axis, and there produce ovules.

a Supposed position of midribs—*b* plantæ axillary.

3. An imaginary section of a pepo explanatory of Dr. Arnott's theory of its construction; copied, but with some modification, to render it more explanatory, from his figure in the Encycl. Brit.

a Supposed position of the midrib - *b* the placentiferous margins represented introflexed, reaching nearly to the dorsal suture, dividing the carpel into two cells.

4. Section of the ovary of Coccinea Indica; the calyx divided in the line of the partitions of the carpella, by which they are permitted to fall apart.

5. Section of the same; the parts *in situ*.

Fig. II.—Section 7. Momordica Charantia.
III.—Section 8. Trichosanthes anguina.
IV.—Section 9. Cucurbita maxima.
V.—Section 9. Coccinea Indica.
VI.—Section 7. Lagenaria vulgaris.
VII.—Section 6. Mukia scabrella.

Obs.—These dissections have been prepared with the view of showing that sections 7 and 9 are not distinguishable by the characters assigned—the anthers being lobed or entire—and that, by taking our characters rather from the form of the anthers than the insertion of the filaments, Trichosanthes and Cucurbita might be advantageously placed in the same section, leaving the character taken from insertion available as a generic distinction between them.

VI.—*Notices of some Roman Catholic Books, existing in the Telugu Language.—By* C. P. Brown, *Esq.*

The Roman Catholic Missionaries, who visited India about the year 1600, were diligent in instructing the Telugus; and their efforts are briefly described by Navarette, one of their number, who, after being employed in China, was transferred to India and subsequently to South America.

The Abbé Dubois gives no very complimentary account of the success of the Catholic Missionaries among the Tamils. The *imitation of the Vedas*, written in Sanscrit, under the guidance of *Robertus de Nobili*, has been described by Mr. Ellis, in the Asiatic Researches; and it is to be wished that a sketch could be obtained of all the Roman Catholic treatises existing in Tamil: some of which have been noticed in the last number of this Journal, in the Memoir of Beschi. Those which are written in Telugu, will now be described. There may perhaps be others: but such are unknown to the native christians who obtained for me the following few volumes.

One of these is a translation or abridgment of the Old Testament history: this is written in a clear and easy style, and may be useful to those who are beginning to study Telugu. It is evidently translated from the Latin Bible: and the ten commandments are arranged as they are in English Bibles.

The version of the Gospels forms a separate work; it is a *Harmony* or selection of chapters, taken from the different Evangelists, so as to form a continuous narrative. Some Romish legends are interspersed; particularly those regarding the Virgin: and paraphrastic remarks are mingled with the text: thus, the Lord's Prayer is quadrupled in length.

The dialect used in these works is very respectable. A few *Italian* words are used; as *Sancto spirito*, and *Pascha*, with *Baptismum*, and

Baptista; there are also a few Hindustani expressions. There is in some passages an appearance of a foreigner's composition, but in general the style is unobjectionable, unless as being a little pedantic.

These books (all unprinted) are usually styled the *Veda:* and those who desire to obtain them should enquire for them under the name of the *Christian Veda.* But the New Testament is often denominated *Suviśesham:* which denotes Good News. It is to be observed that in the Gospels the *doctrinal* portions are usually omitted.

Another volume much read among natives is usually called *Jnana Bodha*, or Instruction in Wisdom, but I do not find any title in the volume. It is a mere set of sermons on various doctrines, wherein there are many allusions to history (even including a notice of *Cæsar Borgia*) but there are few references to the Bible. It is not well written or interesting. An European reader, if acquainted with Telugu, will understand it with ease: but to the natives it is extremely obscure.

There are some trivial compositions which call for little notice: such as the *Devara Talli Dandacam*, or "Chant to the Mother of the Lord." Another hymn or chant is denominated *Jesu Natha Swami Dandacam.*

There remain two volumes which call for more notice, being the *Tobhya* Charitra and the Vedanta Rasayanam. These are written in verse.

The first of these is the legend of Tobit: written in *padya* metre, and contained in three cantos. It is an amplification of the story described in the Apocrypha, and possesses no great literary merit. It is the composition of *Pingala Ellaya*, the son of Mágaya, whom the introduction shews to have been a Jangam. The Jangams narrate regarding their teacher BASAVA, a variety of legends; part of which, particularly those describing his birth are mere imitations of the first book of the RAMAYAN: and these stories are in the present poem related regarding Tobit.

The VEDANTA RASAYAN is entitled to more particular notice: like the poem last mentioned it is in the *padya* metre, or stanzas, and is the composition of Ananda, son of Timmaya, of the Mangalagiri family: the style is purely classical; and judging from circumstances we may consider it to have been written about a century ago. The author's poetical powers are considerable, the taste he shews is good; and the extent of his learning, particularly in Sanscrit, and the classic dialect of Telugu, has gained him much applause. His poem which we may denominate *A summary of the Gospels*, has been mentioned in a former essay, but it merits a more detailed notice. In the usual mode pursued by Catholic writers it describes the five *sorrowful*, and the five *joyful mysteries*, and omits much of the didactic portion. The expressions *Spirito Sancto*, *Baptismum*, &c., are retained. The four books with the introduction contain nearly 4000 lines.

The first book opens with a prayer for the divine blessing on the poet's patron. Precisely following the braminical method, he now describes the family of his patron and that of *Mallarusu*, who is the pupil or questioner: the replies given by the teacher constituting the poem. This mode has been followed by Principal MILL, in his Sanscrit poem, entitled "CHRISTA SANGITA."

The preface being concluded (in 260 lines) the author gives an introduction, which seems superfluous; describing the occurrence of an eclipse: a conversation regarding which leads to the real theme of the poem Mallarusu applies to a hermit named *Parvataya*, or, *Jnána Bodha Muni*, who undertakes to describe the christian religion. As a preliminary, he attempts to describe Deity, and refutes the braminical ideas on this subject; he urges the adoration of God alone. He next describes creation: and the nature of angels. The fallen angels, and the devil as a tempter. These subjects are treated partly in the style of the Latin theologians and partly in a new method such as a native of India might be expected to devise. The system of Hindu idolatry is next combated, and several of the absurd braminical legends are very justly weighed. At the close he says "Let us then desist from regarding Siva, unless in the light of a foe: and let the emblems of such false gods be laid aside."

The second book opens with a benediction in the name of Christ The poet now describes creation. His description of Eve's beauty is quite in the Hindu style, though free from grossness An exuberant description of Paradise. The forbidden fruit. The Temptation and Fall. Then follows a discussion on the origin of evil.

The poet avoids mentioning that Adam and Eve were naked—that the devil was in the serpent's form;—that the curse was inflicted—that Cain slew Abel: indeed he throughout the work passes over in silence whatever he thinks might deter a Bramin from reading his poem.

He now passes to the history of Abraham, then to the birth of the Holy Virgin "who lived with Joseph as with a brother." The birth of Saint John. The Annunciation. The naming of John, and the birth of Our Lord, are described in full detail, and in a very poetical style, (but the circumcision is not mentioned). The hymn sung by the Angels is well executed. The birth is stated to have taken place "in the month Margasira" which answers to December. Here arises a question why the Lord was born not in a palace, but in a stable. The coming of the " Three kings." The alarm of Herod. The interview with Simeon. The flight to Egypt. The disputing with the doctors in the temple.

The third book (which the student should peruse *first*) contains about 1000 lines. It commences with a discussion regarding the Trinity. Then follows the Baptism: with an elaborate picture of the river Jordan. The Temptation; various miracles. The raising of Lazarus is minutely described, in a very poetical manner. The last supper. (But the bread and wine *are not mentioned*). The betrayal to the Jews. The crucifixion.

The fourth book (of similar length) gives further details, with a discussion regarding the possibility of such a death suffered by our Lord. Several apocryphal circumstances are introduced: with a discourse to prove the doctrine of purgatory. The Resurrection. The journey of two disciples to Emmaus is minutely and well described. The doubting of Thomas. The Ascension. The descent of the Holy Spirit. Then follow some apocryphal stories, such as the resurrection of the Lord's mother, " on the third day." Peter appears as the head of the church. A summary of doctrines. The Ten commandments (called Dasa Calpana): the second is as usual omitted. Instructions regarding baptism and prayer: which is to be offered before the crucifix and the Virgin Mary The teacher concludes with very brief instructions regarding the Eucharist. The disciple returns thanks and is baptized.

It is much to be regretted that any apocryphal doctrine should be admitted into a poem written in so excellent a spirit of piety: but the author has adhered strictly to the line laid down by the church of Rome. In poetical merit this poem may probably stand as high as the *Tembavani*, written in Tamil, by the celebrated Beschi. That distinguished genius has introduced into his compositions some of the elegancies of Latin and Italian literature: but in the *Vedanta Rasayanam*, we have a work of great beauty, which in every page bears marks of the author being a native of India.

This poem has been well edited, and illustrated with a verbal commentary or explanation, as the style in some parts is too much elevated to be generally understood at the present day without such aid. For education is at present in the lowest state among the Telugu people; they being nearly as illiterate as were our ancestors at the period when the invention of printing led to the restoraion of learning. A careful study of the *Vedanta Rasayan* may ultimately produce a desire to emulate a poem of merit so distinguished, and will prove that the Telugus possess a christian poet who may rival in talents a **George Buchanan**, or a **Casimir**; and who further, like **Milton**, had the advantage of writing in his native tongue.

VII.—*On the Fossils of the Eastern Portion of the Great Basaltic District of India.—By* John G. Malcolmson, *Esq.*, F. G. S.

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Introduction.

The principal objects of the following paper are, to submit to the Society an account of a series of fossils discovered in the eastern part of the great basaltic district of India; and to endeavour to arrive at some approximate conclusion respecting the geological era of this basaltic formation, which, extending over more than 200,000 square miles, conceals, breaks up, or alters all the other rocks from beneath which it has forced its way. Of the eruptions to which this rich and romantic country (formerly including several considerable kingdoms) owes its existing form, a late President of this Society remarks*, that the mind is almost lost in the contemplation "of their grandeur;" but "that unfortunately the relative age of the eruptions must remain for the present undetermined, no vestiges of secondary or tertiary formations having been detected within the region." Having therefore, in 1832, collected a series of lacustrine fossils, probably referable to the tertiary epoch, from a portion of this district extending 140 miles north and south, and having procured others from localities to the north and west of that which furnished my own collection, I am induced to submit the specimens to the Society[*]. If they should be deemed of sufficient value, I wish a selection to be deposited in the museum, to afford a means of comparison with a duplicate set, which I shall forward to the Asiatic Society of Bengal.[†]

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* See Mr. Murchison's Anniversary Address, Geological Proceedings, vol. I, p. 454.

But it is not alone by supplying some data from which to infer the relative age of the great trap formation, that these specimens are valuable. They will afford the means of connecting the great sandstone formations of the south and north of India, containing the celebrated diamond mines of Parteal (Golcondah), Bangnapilly, and Panna, as well as the limestones and schists associated with them; and which, from the latitude of Madras to the banks of the Ganges, exhibit the same characters, and are broken up or elevated by granite or trap rocks, in no respect differing in mineralogical characters or geological relations. A few remarks on these formations, and the physical geography of the countries in which they occur, will be a necessary introduction to a more particular account of that portion of the trap district in which the fossils were found, Mr. Calder's sketch not being sufficiently detailed, and the map attached to his memoir containing some errors of material importance.[‡]

GENERAL SKETCH OF THE PHYSICAL FEATURES, HYDROGRAPHY, &C.

An elevated tract to the north-west of Bundlecund (not included within the range of the Map,) may be considered as the geological connexion between the provinces watered by the southern branches of the Ganges and the Deckan, including all the countries to the south of the Nerbudda. From the north of this plateau, which extends far to the west, a number of great rivers descend, by a series of rapids and falls over sandstone escarpments, into the valley of the Jumna and the Ganges. From the east and south of the same tract, the Mahanuddy river collects a great body of water, and after a comparatively short course through countries little known, but containing the diamond mines of Sumblepoor and extensive trap and gneiss formations, empties

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[*] See Plate drawn, engraved, and described by Mr. James de Carl Sowerby.

[†] The series of specimens presented by Mr. Malcolmson to the Geological Society have been arranged in the foreign department of the museum.

[‡] Asiatic Researches, vol. xviii.

itself into the Bay of Bengal, not far south of the Delta of the Ganges.

The Nerbudda, which flows in an opposite direction, is more interesting in a political and geological point of view; and the extensive countries through which it passes have been more carefully investigated than any other part of the Peninsula. This river takes its rise to the west of Amerkantack, and traversing a country of granite, sandstone, and basalt, abounding in iron and the finest dolomitic marbles, reaches the Indian Ocean through the alluvial plains of Guzerat. At Jabulpoor and in the neighbourhood of Saugur, fossil mammalia, shells, and silicified palms have been recently discovered. Fossil shells have also been found in some of the trap hills, which have broken up the sandstone near the sources of the Taptee. This river is separated from the Nerbudda by a range of basaltic mountains; and having the same direction as the Nerbudda, its whole course appears to be in the basaltic formation. (See N. W. corner of Map).

All the other great rivers of the Peninsula, including the Godavery, Kistnah, Pennar, and Cauvary issue from the western Ghàts, from the summits of which the country slopes gradually to the east, except at the extreme south, where the descent to the plains of the Carnatic is considerable and precipitous.

The Godavery (see Map,) rises in the basaltic region described by Colonel Sykes, (Geol. Trans. vol. IV pt. 2, 1836) and, greatly increased in size, it enters the granitic table land of the Deckan, and flows at the southern foot of the Sichel Mountains into a sandstone and argillaceous limestone country. This district is similar to that of Bundlecund and Malwa; it also contains diamonds, and has been much broken up by erupted rocks. From the north, the Godavery derives large supplies of water from the great rivers rising south of the Nerbudda and the Taptee, in basaltic tracts, the soil of which being retentive of moisture, the water is everywhere near the surface. From the south it receives only the Munjerah river, which, flowing through arid granitic plains, furnishes but a scanty addition of water, except during the rainy season. Through a pass in the gneiss mountain of Papcondah it enters the plains of the Coromandel coast. In this district the sandstone reappears, at an elevation little above that of the sea; but basaltic hills, several hundred feet in height, in which marine fossils have recently been discovered, exist almost within the delta formed by its sediment.

The Kistnah derives its waters from a number of considerable rivers, rising in the basaltic and gneiss summits of the western Ghats, which condense the greater part of the clouds carried by the south-west monsoon from the Indian Ocean. Flowing through the territories of the southern Mahrattas, a country covered with a rich basaltic soil, and abounding in schistose limestone, sandstone, granitic rocks, and basalt, it enters the granitic platform of the Deckan, the limits of which in this direction are unknown. The limestones and sandstones, however, soon reappear on descending the river, and extend across to the basin of the Pennar, and as far as the ascent to the granitic platform of the Mysore. It is on the banks of the Kistnah that the richest diamond mines occur, and that the sandstones acquire their greatest elevation, amounting to more than 3000 feet; the river passing through mural precipices of this rock and of the schistose limestones to be presently described. It then enters the plains of the Carnatic, where the same rocks occur, sometimes a little elevated above the level of the sea, at others forming the caps of granite mountains, or broken up by varieties of greenstone and basalt. Thence, passing through a narrow gorge in the gneiss hills of Bezwarrah, it enters the alluvial plains continuous with the delta of the Godavery. Its waters, however, are more loaded with mud than the last-mentioned beautiful river, and the deposit of new land may be seen, by the inspection of a common map, to be proportionably great.

The Pennar is comparatively a small stream, but of much geological interest, the greater part of its waters being derived from the districts in which the diamond sandstones and the argillaceous limestones, on which they rest, are exhibited in their most characteristic forms, and where they are most easily investigated. To describe these strata in detail would be out of place here; but a few of the leading facts must be stated, that the identity of the formations with those of the fossiliferous district, more immediately the object of this paper, may be rendered manifest. Like all the rivers of Southern India, granite is frequently seen in the bed of the Pennar, more especially in its southern branches, where the passes of Ryachottee lead to the granitic table land of Mysore, having an elevation of 3000 feet above the sea, or 2500 above Cuddapah, the principal town of the Pennar basin. With these exceptions, and the occasional appearance of trap through the stratified rocks, the rest of its course, till it approaches the sea, is over rich plains of black and saline alluvium, derived from the decomposition of basalt and of the stratified rocks so often referred to. From these plains numerous table lands, insulated eminences, and ranges of hills, having for the most part a direction nearly N. E. and S. W., rise abruptly, presenting mural precipices of difficult access, around the base of which the roads often make extensive circuits. The Nulla Mulla hills extending from the Mysore frontier to the basins of the Kistnah and Godavery, and the minor ranges dependent on them, and having the same composition and direction, are crossed at right angles by the Pennar, which makes its way through them, like the Kistnah, by traversing narrow gorges, with perpendicular sides.

There is not a more remarkable phenomenon in the district watered by the Pennar than the horizontal summits of many of the ranges, and the distinct manner in which the continuity of the strata can be traced from one hill to another, although extensive plains intervene; while, at no great distance, the sandstone which forms the summits of these hills is seen on the same level as the surrounding plains. Numerous instances also occur in which the original continuity of the horizontal summits is easily traced; the strata on the opposite and nearly perpendicular sides of a valley being similar, but having a considerable dip, the beds descend to the general level of the country. A good example of this is seen, in Section 2, Pl. 6., at Chintagoouta and Gundicottah. These anomalies were at first quite inexplicable, nothing appearing in the valleys but a rich alluvium, nor on the summits (which are reached with much difficulty) but a sandstone perfectly horizontal, and divided into huge tables by perpendicular partings, sometimes separated several feet from each other, and filled with broken pieces of the rock. This jointed structure is common to the sandstone, the schistose beds on which it for the most part immediately reposes, and the stratified limestone into which these schists pass insensibly; but the size of the tables so formed, varies from rhombs of a few inches, in the schist and lower part of the sandstone, to enormous masses on the summits of the hills. Nowhere is this structure and the succession of strata, of which it is characteristic, better seen than in the table land in which are situated the celebrated diamond mines of Bangnapilly and others now deserted. From the accompanying plate some idea will be gained of one of these mines.*

The plains at the base of the table land of Bangnapilly consist of a rich black alluvium, containing fragments of basalt, jasper, and the various minerals found in the hills. It rests on a fine, compact, dark blue or nearly black limestone, which contains much argillaceous and siliceous matter. This limestone abounds with springs, and is in some places so cavernous as to afford passage to subterranean streams. Basalt protrudes in a few places near Bangnapilly. On ascending the hill, the limestone becomes more schistose, and is of a paler colour, gradually approaching in its structure and composition to clay slate, but it is far more friable. On the schist a more or less compact sandstone rests varying very much in colour, composition, and appearance in different places. Above Bangnapilly it contains the diamond breccia described by Voysey. As far as the shafts which I had an opportunity of observing, enabled me to judge, the breccia is not an interstratified rock, but an intermixture of the common sandstone, in different parts of the same stratum, with larger fragments of older rocks, generally rounded but sometimes angular. It is not, however, the object of this paper to describe the mines and the interesting district in which they occur further than is necessary to exhibit the type of the formation, by the study of which I was enabled to understand more clearly, the less distinct appearances exhibited by the same rocks, where they have been invaded or buried by the great basaltic eruptions of Central India. On the opposite or west side of the valley, the hill is composed of the same argillo-calcareous formation ; but, according to Colonel Cullen, " instead of a sandstone cap, it is crested in its whole length with a sharp black ridge of trap rock, formed of loose blocks piled upon each other, the apparent base of which observed a pretty uniform level, nor is the ridge of much depth. Its extreme narrowness, deep black colour, and the total absence of all traces of vegetation, formed a singular contrast to the rest of the hills, which were covered with long dry grass and scattered bushes*." At a small pass some miles further to the west, the road in ascending, passes over first the dark limestone and a narrow belt of schist, then trap, which is again succeeded by limestone, and the latter by schist, nearly to the summit, " which is capped with a rock of a beautiful flesh colour, with specks and shades of a beautiful green, as if connected with its vicinity to the trap, and of so close and fine a texture as to appear homogeneous even with a lens." " The descent of the pass on the opposite side consists of a clay slate nearly to the foot, where the limestone reappears, and these two rocks continued to alternate with each other to the foot of the second Ghàt, which, like all the former, was composed of clay slate capped with quartzose sandstone†."

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* The plates will be given in our next number.—Ed. Madras Journal.

The sandstone exhibits many varieties of grain, colour, and hardness: in some places it is white or red, and can be cut into pillars and slabs of great size and beauty ; in others it is soft and friable, and its inferior beds are not unfrequently schistose, so as to be with difficulty distinguished from the subjacent rock, with which it has in one or two places been observed to alternate. Where the sandstone approaches the great granitic tracts to the south and west, it passes into a compact quartzose rock, as is seen on both sides of the Tripatty Valley. This passage is also observed in other places, as near the Cuddapah diamond mines, where the plentiful occurrence of basaltic pebbles shows the neighbourhood of the trap. Besides the diamond conglomerate, consisting of a great variety of minerals, seams of rock crystal occur, and a fine white quartz containing argentiferous galena, which in former times furnished the country with lead. Specular and micaceous magnetic iron ores, but containing much peroxide, and common iron pyrites, occur with the galena. As far as I have observed, the sandstone always rests conformably on the schists, although from its jointed structure it occasionally, when elevated, appears to meet the subjacent rock at a more or less obtuse angle.

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* Colonel Cullen, in Transactions of the Literary Society of Madras, January 1837 p. 50.

† Ibid.

The schists on which the sandstone rests, vary very remarkably in colour, being in different places blue, red, green, or pure white, in which they seem to bear some relation to the incumbent sandstone. They are also occasionally flinty or jaspideous. Sometimes they are wanting, the sandstone resting directly on the limestone, of which the schists are evidently merely the upper beds, and into which they pass insensibly, although it seldom happens that considerable effervescence does not occur on examination by tests. It is in many places impossible to say to which portion of the series any particular specimen belongs.

Voysey has classed the schists with the sandstone under the name of " (the clay slate formation ;)" I have, however, preferred to designate the deposit " argillaceous limestone," a term used by him in one of his sections as applicable to the limestone, and which well expresses not only the general character of the rock, but that also of the upper schistose beds.

The limestone is a compact rock, but the strata are usually thin, and are often intersected by vertical partings, a circumstance which frequently limits its use in ornamental architecture. Its most common colour is a light blue, passing into black ; but it occasionally occurs of a nearly pure white, and affords an admirable material for basso-relievos. On this stone the finest sculptures of the ruined city of Amrawuty are executed, and for delicacy of workmanship they have perhaps never been surpassed. Were it not for the occurrence of small crystals of quartz, the same quarries would furnish an excellent lithographic stone. Near Cuddapah the dark variety is the common building stone, and many fine columns, caryatides, and cisterns are composed of it. The stone is applied to the same objects in the southern Mahratta country, and along the course of the Godavery towards Nagpoor.

To the south and east of Cuddapah, a narrow valley, nearly 150 miles in length, extends through the limestone, the strata of which are in some places nearly vertical, but form rounded hills. In others they are capped by sandstone, which exhibits mural precipices of much grandeur, and almost or entirely inaccessible. The strata, for the most part, dip to the N. W., resting on the granite of the Carnatic. This rock is penetrated by many dikes of greenstone, which have evidently been instrumental in elevating the stratified rocks to their present singular positions. Little has yet been ascertained regarding the thickness of these strata, which differ much even in the same range of hills. The only minerals they have been ascertained to yield, are varieties of quartz and iron pyrites, the latter of which is so abundant in a few localities, that sulphur is manufactured from it. At Jumulmudagoo I found the limestone interstratified with muriate of soda; and it is therefore probable, that the salt diffused through the alluvial soil so extensively as to render the water of the Pennar brackish during the hot season, and the inhabitants independent of the sea-coast for a supply of that article, is derived from this source.

On emerging from the gorge in the Nulla Mulla range, the Pennar enters the plains of the Carnatic, and near its mouth flows through low hills of laterite. This deposit rests on the ordinary granite of the Carnatic, with its associated sienites, hornblende schist, quartz rock, and mica slate. It is in a rock composed of a mixture of the last two minerals, that the copper-mines of the Nellore district are situated*. In the same neighbourhood, the sandstone and argillaceous limestones are little elevated above the sea, and are continuous with the same rocks on each side of the Kistnah. They are broken through by insulated basaltic hills, in the neighbourhood of which subterranean sounds and frequent local earthquakes are reported to occur; an assertion I am the more inclined to believe, having myself experienced two slight shocks during a casual visit to the district.

Having briefly described some of the more remarkable phenomena exhibited by the southern portion of the great sandstone and argillaceous limestone formations, it will be unnecessary to enter into any detail when we meet with the same rocks to the north of the Godavery in connexion with the fossil beds discovered in the great basaltic district.

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* The ores are of various kinds, but the richest is a sulphuret, containing, according to Mr. Prinsep, 69 per cent. of the pure metal. The copper also occurs in a slate which Mr. Ouchterlony, of the Madras Engineers, informs me, was considered in Cornwall to be identical with the Killas. If this slate belongs to the "argillaceous limestone" formation, the fact will be of use in determining the relations of that rock to the gneiss, talc slate, and mica schist; a subject on which no observations of any value have yet been made. The primary rocks of this district contain magnetic iron ore and corundum, both of which occur in the diamond sandstone.

GRANITE PLATFORM BETWEEN THE KISTNAH AND GODAVERY.

(See Map and Section I.)

With regard to the granitic platform of the Deckan, which intervenes between the Kistnah and Godavery, much accurate information is already before the public; it will therefore be necessary only to observe, that it is intersected by numerous greenstone dikes (sometimes of greenstone porphyry), having for the greater part a direction from S. by E. to N. by W., and not very different from that of several of the ranges of basaltic mountains to the north.

These dikes, and the detached masses connected with them, are entirely composed of a crystalline compound of hornblende and felspar, without distinct crystals of augite; and I have never detected olivine in them.* The rock shows a tendency to separate into spheres composed of concentric layers and into irregular prisms; and the same structure in some degree occurs in the granite, sienite, pegmatite, &c. of the whole of the south of India. The greenstone is exceedingly hard and difficult to work, but it takes a most beautiful and durable polish, as in the magnificent mausoleums of Golcondah, the tombs of Hyder Ali and Tippoo Sultan, at Seringapatam, and in many of the sculptures of the Carnatic pagodas†. Where these dikes rise into hills, the summits only are composed of the compact greenstone, which graduates below into the granite of the surrounding country. Many of the veins of basalt in the passes of the Mysore and Neilgherry mountains differ from these, in possessing the structure of the compact basalt of Bombay and other places in the trap countries, and in branching into narrow veins, (often not an inch thick,) which traverse the granite without mixing with it; while the ordinary greenstone dikes of the Deckan are almost always accompanied by separate nodules, of greater or less dimensions, insulated in the granitic mass, the component parts of which appeared to me to be there, in most cases, arranged in larger crystals, and to be more subject to decay, than in other places. I could not resist the inference, that, at the time of the formation of these dikes, the granite was in a state approaching to fluidity; although, as some of the narrow veins can be traced for many miles through the granite, they do not appear to have been formed at the same time.

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* "In a specimen in the Geological Society's Collection, taken by Dr. Voysey from a '*greenstone dike*' passing through granite at Guntoor, south of the Kistnah river, olivine is diffused amongst the other constituents of the rock." June 25th, 1839.

† It is familiarly known in India as "black granite."

Several small basaltic hills are insulated in the granitic platform in the line of route between Hyderabad and Nirmul, and they are based on decaying granite. Their flat summits and steep sides correspond with the hills of the great trap district; and the general line of bearing, of the broken ranges of which they appear to form a part, does not differ much from that of the basaltic mountains to the north, or from the greenstone dikes; but many hills are scattered over the plains to the east and west, and cross this line of route in every direction. The lower part of the hills is composed of thin tables or laminæ of a sonorous trap, and the upper of globular concentric basalt; the external layers of which are extremely friable, generally grayish, or soft and soapy to the feel, and are of a greenish tint, except where the stone is much loaded with ferruginous grains of a reddish brown colour. In some places the metallic matter has the appearance of having been partially smelted, and is of a fine red hue.

The nuclei of the "concentric basalt," which are exceedingly tough, and resist decomposition powerfully, are of a deep black colour, and contain large crystals of olivine, and small kernels of calcedony. The first of these minerals is not found in the soft external coats, yet it is so closely united with the substance of the rock as not to admit of a doubt of its being of contemporaneous formation, and not, as supposed by Berzelius*, a fragment of a pre-existing stone enveloped in the liquid matter. Small, but very characteristic specimens of calcedony are of more frequent occurrence in the softer portions of the rock, especially between the concentric nodules; but they are intimately mixed with their substance. It is remarkable, that I detached no calcareous minerals in similar situations in these hills, although the rock is so impregnated with lime as to have led to an extensive deposit of calc-tuff (Kunkur), at present forming along its base, and projecting sometimes half a foot from between the partings of the basaltic tables.—"The presence of olivine, the soft wacké in which the globular basalt is imbedded, the less crystalline structure, the passage into a porous amygdaloid, containing calcedonies, zeolites, &c., and the granite in the neighbourhood of all the smaller masses differing little from that at a distance," may perhaps be sufficient to distinguish these insulated basaltic hills from the greenstone†.

On approaching the Godavery, the granite in some degree changes its appearance, containing large and beautiful crystals of red felspar, occasionally imbedded in veins of transparent quartz, clouded with spots and wavy lines of a turbid milky colour. Greenstone dikes are there more common. The river flows over granite, which is intersected by several dikes of greenstone, running more in a north and south direction than those above referred to, and having many minute white crystals diffused through their substance. The dikes project from 8 to 10 feet above the granite, and are divided into rhomboidal masses by fissures, in which lime is deposited. The bed of the river is covered by numerous fragments of calcedonies, zeolites, and other minerals found in volcanic rocks; and they have been cemented into a more or less solid calcareous conglomerate. The banks are composed of a black basaltic soil, from the lower part of which, where it rests on the granite, as well as from the divisions between the several layers of alluvium, thin slabs of a clayey calc-tuff (Kunkur) project, and are connected above with portions formed round the roots of plants, and below with other layers spread out between the different strata of alluvial earth*. These appearances sufficiently indicate the neighbourhood of the basaltic range of mountains, distinguished in Arrowsmith's large map as the Sichel or Shesha hills, but which are locally known by the name of the Nirmul range, from the large town situated six miles from the difficult pass leading up the steep escarpment presented by their southern face. None of the stratified primary rocks are seen at the foot of these hills in the line of the section; but twenty miles to the east of Nirmul, and a few miles south of the mountains, hornblende slate occurs, resting on granite and quartz rock.

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* Edinburgh Journal of Science, January 1839.

† Journal of the Asiatic Society of Bengal, February 1836, p. 105.

Iron Ore, Mines, and Manufacture of the Steel.—The magnetic iron ore, employed for ages in the manufacture of the Damask steel used by the Persians for sword-blades, is obtained from this schist. The mines I examined, are those of Deemdoortee, but the ore is extensively distributed. The minute grains or scales of iron are diffused in a sandstone-looking gneiss or micaceous schist, passing by insensible degrees into hornblende slate, and sometimes containing amorphous masses of quartz. The strata are much broken up and elevated, so that the dip and direction are in no two places the same, and bear no relation to the mountains to the north.

Manufacture, &c.—The mines are mere holes dug through the thin granitic soil, and the ore is detached without difficulty by small iron crow-bars. It is then collected and broken on projecting masses of granite or quartz by means of a conical-shaped fragment of compact greenstone; but when too hard to yield to this simple instrument, it is previously roasted. The sand thus procured is washed in shelving depressions dug near a tank, and the heavier parts, separated by this process, are exactly similar to Voysey's specimens of the iron-sand used in the manufacture of Damascus steel at Kona-Sumoondrum, in the same neighbourhood; but from his published papers, it does not appear that he had seen the rock from which they were derived. In other respects, all the information I could procure, accurately corresponds with that given in his interesting paper.* The ore is then smelted with charcoal in small furnaces, which have often been described. I did not see any flux used; but, although I watched the whole process, from the digging of the ore till it was formed into bars, I will not assert that none was employed. The iron has the remarkable property of being obtained at once in a perfectly tough and malleable state, requiring none of the complicated processes to which English iron must be subjected, previous to its being brought into that state. Mr. Wilkinson, who has investigated the history of Indian steels with much scientific and practical skill, did me the favour to submit to experiment a specimen of this iron as it came from the furnace. He found it extremely good and tough, and considered it superior to any English iron, and even to the best descriptions of Swedish. The Persian merchants, who frequent the iron-furnaces of Kona-Sumoondrum, are aware of the superiority of this iron, and informed Dr. Voysey, that in Persia they had in vain endeavoured to imitate the steel formed from it; a failure which could be ascribed only to the difference of the materials used, as the whole process of the conversion into steel was conducted under their own superintendence. It is also probable, that there are few places in India where an ore of equal value is so easily procured; otherwise its distant inland situation, in a difficult and unsettled country, would not have retained a reputation for so many ages. In the manufacture of the best steel three-fifths of this iron is used; the other two-fifths being obtained from the Indoor district, where the ore appears to be a peroxide. It is evident, that if the beautiful water of the Damascus blades is derived from the crystallization of the steel, the use of two very different varieties of iron, one of which has been ascertained to be of such admirable quality, must have an important influence on the appearance and quality of the manufacture.

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* Further details on this part of the route will be found in some notes explanatory of a collection of specimens presented to the Asiatic Society of Bengal, and published in the Journal of that Institution for February, 1836.

As these mines afford a boundless supply of ore easily wrought, and are situated in the neighbourhood of vast forests, and near a river navigable for boats during part of the year, it is probable, that at no distant period, when the native government has undergone some amelioration, iron may become an important article of commerce. On this account, and because, although much has been written regarding Indian steel, nothing has yet been brought prominently forward regarding the finer kinds of iron ore with which that country abounds, I will make a few additional observations regarding them.

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* Journal of the Asiatic Society of Bengal, vol. i., p. 245.

Dr. Heyne has accurately described the manufacture of iron in the Carnatic, to the south of the Pennar river, and he states that it is, when first smelted, extremely brittle, requiring several operations to bring it into a malleable state. I possess specimens of two varieties of ore used in the district in which he observed the processes, and where I have myself seen them carried on. The one, an iron sand, collected in the beds of rivers, consists of the protoxide, mixed with much of the peroxide; the other, a red schist, is almost entirely composed of red oxide, but in the centre of the mass it affects the magnet. Not far from where this rock occurs, I collected specimens of hornblende schist, leaving little doubt as to the ores being of the same nature, the former having become altered *in situ*, in the same manner as some of the superficial strata at Deemdoortee are seen to do. I therefore conclude, that the superior quality of the Nirmul iron depends on the ore being a comparatively pure protoxide. It certainly is not dependent on the nature of the fuel, which is much the same in both places*. Captain Herbert, indeed, long ago suggested, that the superiority of the Gwalior iron over that principally worked in the Himalayahs, depended on the former being a magnetic ore, like that of Sweden; but the first accurate information on the subject was communicated by Dr. Royle to Mr. De La Beche, who states†, on the authority of that gentleman, that magnetic iron ore is extensively diffused in hornblende slate in the central range of mountains in India, and that it also occurs in the Himalayahs. This geological position corresponds with that of the Nirmul ore; but the latter does not bear any resemblance, except in its peculiar lustre, to the Menaccanite of Cornwall, to which it is compared by Mr. De La Beche;

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* Iron, which has been ascertained to be superior, for many purposes, to the best German iron, has been recently imported from the western coast of India; but the mines from which it was obtained have not been examined. Captain Jervis, of the Bombay Engineers, however, informs me, that ores, powerfully affecting the magnet, exist in great quantity at Taygoor, a village of the Koncan, not far from the port from which the iron in question was procured.

† Manual of Geology, 3rd Edit., p. 435.

nor could I detect any titanium in it. With regard to the geological relations of the magnetic iron ore, it is also necessary to observe, that in India it is not confined to the hornblende schist, but is found extensively distributed in the granite and gneiss of the Carnatic and Mysore, in quartz rock near the iron works of Porto Novo; and, as has already been observed, associated with galena in the diamond sandstone of Cuddapah. The discovery of a mineral, so generally confined to the primary rocks, in the great sandstone formation, affords an additional argument in favour of the opinion of those, who consider this rock and the subjacent schists, as equivalents to the older European sedimentary formations, rather than to those of the supermedial order.

DESCRIPTION OF THE SICHEL HILLS, AND OF THE FRESHWATER SHELLS.

Returning to the line of route, the granite, on approaching to the Sichel hills, becomes softer and decomposes rapidly; and the soil gradually changes to the well-known black basaltic mould, known in India by the name of "cotton ground," and, as usual, it is mixed with calcedonies, zeolites, &c. Amongst these minerals were some fragments of a red colour, and considerable specific gravity, though full of irregular cavities, and so like the slag of an iron furnace, that I considered them to have had that origin, till I discovered a considerable mass of a similar nature protruding from the granite and black soil by which it was covered. Along with these fragments were others of a semivitrified matter, containing small white crystals of felspar, and hardly to be distinguished from a piece of granite fused by Dr. Voysey in the steel furnaces of the neighbouring district. The granite constitutes the surface rock a little further, gradually passing into a black compact basalt, intermixed with many white spots, apparently of felspar. The trap then becomes softer, forming small hills of a cellular amygdaloid, abounding in cavities lined with green earth, and many of them filled with calcedonies, zeolites, quartz crystals, and, more rarely, calcareous spar, of the same kind as those, so remarkable for their beauty, in the portion of this formation described by Colonel Sykes (Geological Transactions, vol. 4, p. 422*). The crystals also occur in seams, or are diffused through the trap; and in both cases are intimately mixed with its substance. In the bed of a torrent between two of these hillocks, I met with some soft, clayey, schistose fragments, and others of a siliceous character, and of a black bituminous appearance in the centre, containing very perfect specimens of the *Paludina Deccanensis* (Pl. fig. 20,) and fragments of other shells to be hereafter described. Those which I examined were converted into calcedony. A laborious research on the hill failed to discover them *in situ*; but about half-way up the escarpment of the principal mountain, which is very steep, and composed of concentric nodular basalt, imbedded in a soft greenish wacké, a narrow band of a singular quartz rock projected about two feet from the surface. It was remarkably scabrous, of various shades of white and red, and had cavities on its surface covered with fine silky crystals. It had every appearance of having been forced into its present situation, when the basalt covered and partially melted the bed to which it belonged. Many fragments of this rock were found below with the shells; and it was again met with, together with the same and other fossils imbedded in basalt, near Hutnoor. The specific gravity of this rock is 2·473, and some of the specimens effervesced feebly in acids, a portion of lime being dissolved; circumstances in which it corresponds with a similar formation found by Voysey, associated with shells, probably of the same kind, at Medcondah (south of the Godavery), an insulated basaltic hill resting on granite, to which I shall have occasion again to refer. The highest summit of the hills, above the locality of the fossils, is conical, but it is capped by a perfectly horizontal stratified rock, the nature of which I could not determine. It is most probably tabular basalt, although that rock is seldom found in similar situations.

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* A beautiful variety of chabasie, having the angles replaced by triangular or pentagonal faces supporting a rhomboidal surface, of which beautiful specimens abound in certain localities of the western portion of the formation, has not been met with in this neighbourhood; but, like some other minerals of the basaltic district, it is not generally diffused in the rocks where it is most abundant; so that I have travelled for several hundred miles without meeting with it.

Such are the appearances presented on ascending the difficult pass leading up the steep escarpment of the Sichel hills, which form the southern boundary of the eastern portion of the great trap formation of Central India. The hills extend from the junction of the Wurdah and Godavery rivers (the basins of which they separate), till they are lost in the gradual rise of the country to the west, near Lonar (lat. 20°, long. 76°, 30′), in the province of Aurungabad. Their direction is W. N. W., and, as far as can at present be inferred, they seem to be continuous to the east with numerous ranges of basaltic, sandstone, and granitic hills, extending to the Eastern Ghàts, at the lower parts of the course of the Godavery. The extreme breadth of the range, from the foot of the Nirmul pass to the town of Yedlabad, (nearly on a level with the plain country of Berar,) is about 40 miles ; but several smaller hills having for the greater part the same direction, are intimately connected with them to the north, as far as the Wurdah river, which has an elevation of little more than 600 feet above the sea. The Sichel hills are arranged in terraces, with steep sides having projecting spurs, and their summits rise occasionally into conical elevations with rounded or flat tops. They inclose narrow valleys abounding in streams, or support table-lands covered with black soil strewed with trap boulders, and having water everywhere near the surface. A thick wood and grass jungle, composed of very different plants from those common on the granite hills, cover the whole tract, with the exception of the flat summits and some of the terraces, and render it unhealthy for the greater part of the year. The basalt of which they are composed, is generally globular, the spheroids being sometimes of great size; but in many of the water-courses, even of the elevated table-lands, it has a stratified appearance. Small basaltic columns are also met with on the crests of some of the spurs and higher ridges; and where they occur, no fossils and few minerals are found. Granite not only forms the base of the hills at Nirmul to the south, and Yedlabad to the north, but part of the mountains themselves, the basalt being seen to rest on decomposing granite about the centre of the range, in a deep ravine, through which the Koorm river passes; it also again appears high in the table-land to the north of that river, and in one of the terraces of the northern descent, where the most extensive fossil beds were found. Further detail is unnecessary, as Dr. Voysey's admirable description of the Gawilghur mountains, forming the northern boundary of the great and fertile valley of Berar, as these hills do its southern limits, applies equally well to both ranges*.

The fossils were first discovered *in situ*, near Munoor, in the basaltic table-land north of the Koorm river; and were subsequently found in the descent of the hills towards Hutnoor, and in different parts of the Mucklegundy pass, leading into the Berar valley. They consist of numerous gyrogonites; two species of Cypris; two, or perhaps three, species of Unio; and many individuals referable to the genera Paludina, Physa, and Limnea (see Pl.). The rock in which they occur, varies in different places. Some of the finest specimens were procured from a red chert with scabrous furface, having silicified shells distributed throughout its substance, or projecting from its surface. The chert is deeply imbedded in the nodular basalt, from which it projects in some places several feet. The finest specimens of Unio occur in a beautiful gray chert, imbedded in the basalt, or resting immediately on it, the under surface being plain and smooth, while the upper is rough, from portions of the large shells which project from it. On breaking up one of these masses, it was found to contain entire Unios, many of them having the valves connected and closed, or partially open; the interior being filled with the same chert, spotted with fragments of shells, minute univalves, and fine specimens of the two species of Cypris, which occur so abundantly. Some parts of the rock exhibit a mixture of sand, clay, and fragments of shells, of very moderate hardness; but the greater portion consists of chert, the materials of which are occasionally arranged in a beautiful, light blue, enamel-like substance, around irregular cavities containing crystals of purple quartz. Some portions also exhibit a minute vesicular structure; and the whole appearance of this beautiful rock forcibly impresses the mind with the conviction, that it owes its present appearance to the action of the great basaltic eruption, which has enveloped it and the organic remains. The greater number of the shells are converted into chert, but a few retain their original structure; and in some instances the calcareous matter has been converted into crystals of calcareous spar. Many internal casts of entire shells are found in the substance of the rock, to which they are united at a few points only, a greater or less space being left unoccupied; in others, the entire shell is converted into siliceous matter, retaining the appearance even of the ligaments unaltered; and fortunately, in a few cases, the hinge and teeth are excellently preserved.

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* Asiatic Researches, vol. xviii.

Numerous fragments of shelly rock, differing much in appearance, lay scattered about over the table-land; consisting partly of a fine blood-red chert, like that above described, and containing the same shells. The gray chert was more sparingly distributed, and the Unios did not occur in the other fragments. Some of them, composed of a tough white clayey stone, so soft as to soil the fingers, contained Physæ, Paludinæ, and Limneæ, mostly converted into calcedony, but others also retained their original structure, and effervesced with acids. Portions of charred vegetable matter, resembling small fragments of grasses and reeds, occurred in these and the harder cherts. Other specimens are composed of a greenish blue crystalline mass, resembling an ore of copper, (but it is of low specific gravity, and contains no trace of that metal,) and the shells contained in them are converted into the most beautiful crystalline quartz, retaining the form of every convolution of the Physæ and Paludinæ. The cells of this stone are often coated with fine silky crystals. Masses of a hard coarse chert, consist almost entirely of Gyrogonites, but contain many of the same Physæ and Paludinæ. This rock appears to have formed beds of about half a foot in thickness; but it was not discovered *in situ*. A stratified rock was however found in the neighbourhood, resembling some specimens of the argillaceous limestone of the diamond districts, but consisting of a compact whitish chert, which contained Paludinæ, and the finest specimens of Gyrogonites (Plate, fig. 1). Night prevented the connexions of this rock from being determined: the strata were, however, ascertained to be of considerable extent, and to be much buried in the soil; there were also numerous fragments of siliceous rock, partly converted into a black bituminous flint, or a coarse quartzose rock, partially altered into calcedony, by which most of the shells were also replaced.

The masses of red chert protruding from the basalt contained, besides the Testacea, small portions of silicified wood, and what I consider to be the fragment of a bone, and of the tooth of a mammiferous animal. The specimens, however, are too imperfect to admit of any certainty as to what they really are; but it is not unlikely that such remains should occur, and I therefore do not suppress what may lead to a more successful inquiry

On descending towards Hutnoor, granite, presenting a concentric, ligniform surface, from the unequal decomposition of the quartz and felspar, occurs at a short distance from the fossils*. With this exception, the basalt continues of the same character as before, and fragments of red or deep black chert, containing Paludinæ, are found in the beds of torrents; and at Hutnoor they occur in the trap. There is much calcareous matter mixed with the soil, or collected in nodules, and it appears to be derived from the lime contained in the basalt, or between its laminæ. On the pioneers attached to our camp penetrating, at Elchoda, through some strata of tabular basalt to obtain water for the troops, seams of a pure white, pulverulent lime were found between the layers†. At Hutnoor fragments of a compact blue limestone, not to be distinguished from that of the diamond districts, were collected; and the rock to which they belonged, was found in the descent from the first of the three principal terraces by which the road leads to the northern base of the hills. The strata were much inclined and broken, but the forest was so thick, that I could not trace them for any distance. After descending to the second terrace, the surface rock suddenly changes to a white, horizontally-stratified limestone, almost entirely composed of large bivalve shells, the edges of which decomposing more slowly than the cement, the natives have applied to it a name signifying impressions made in clay by the feet of sheep. The thickness of the bed in one place, where it is intersected by a torrent, is 12 feet, and it rests directly on red granite A great spur, from the upper part of the mountain, extends across the terrace, rising precipitously above the fossiliferous limestone, a few hundred yards from the spot where it rests on granite; and has buried the continuation of the stratum under an accumulation of basaltic *débris.* Where the limestone becomes concealed in the basalt, a friable, gray, cellular mass, resembling ashes, occurs, apparently imbedded in both these rocks. The fossils are composed of granular limestone, the matrix consisting of calcareous matter mixed with the ash-like substance, and small fragments of granite. Some of the shells are of great size, but they are ill preserved, and I found only one specimen with the valves united. These shells, I erroneously considered to be marine (principally from the appearance of those represented in Plate, fig. 4 to 8, and some of the large flattened specimens). Mr. Lonsdale, however, who had the kindness to examine some of them, considered their general character to be that of fresh-water species. I had previously detected, in a fragment of a compact argillo-calcareous stone found at the bottom of the little cliff where the granite is seen to underlie the fossils, a number of very perfect Melaniæ; I therefore re-examined the different specimens, and detected in them fragments of the same kind as those in the limestone; and Mr. Sowerby has since been able to extract from the latter, specimens sufficiently distinct to be identified with the *Unio Deccanensis* (Plate fig. 4 to 10), found in the chert at Munnoor, and another species (*Unio ? tumida*, fig. 11 and 12,) not yet discovered elsewhere. No other fossils were found in this locality.

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* A similar appearance has been observed at the foot of the Nirmul pass, at the iron mines of Deemdoortee, and in Bundlecund.

† The same was observed in Bundlecund by Captain Franklin. (Asiatic Researches, vol. xviii.)

When it is considered, that the accumulation of freshwater shells occurs on the precipitous descent of a mountain range, ascended with much difficulty by travellers, it will be evident that the aspect of the country has been entirely altered since these animals lived.

COUNTRY BETWEEN THE SICHEL HILLS AND NAGPOOR.

Towards the foot of the pass, the rock changes from the nodular basalt to amygdaloid; and near its junction with the granite, masses of greenstone porphyry, with large crystals of felspar, occur. The granite then reappears, protruding in rounded masses through the soil of the level country around Yedlabad. The bed of a stream near that town is strewed with fragments of blue limestone and schist, resembling those of the basins of the Pennar and Kistnah ; and higher up the stream, a fine white quartzose sandstone, having a few imbedded fragments of quartz, is found *in situ.* It dips at a slight angle to the south-west*. The surrounding country is covered by a deep basaltic soil, so that the rock on which it rests could not be discovered ; but the argillaceous limestone, passing, in its upper strata, into a greenish or red schist, is traversed by a stream a few miles to the north. Short ranges of trap hills, some of them at nearly right angles to the Sichel mountains, occur to the north-east ; and beyond them, an extensive tract of sandstone has been traced for a great distance along the Wurdah.

At Zynad, argillaceous limestone appears on the surface for several miles, and agrees in every particular with the compact marbles of the diamond districts of the Pennar and Kistnah. The strata sometimes dip at an angle of 40 degrees, but they are in general nearly horizontal, the edges of the layers being disposed in steps on the slopes of gently-rising grounds. Rock crystal and calcareous spar are distributed in thin seams between the strata, as well as through the substance of the rock ; and along the vertical partings of the strata, there are rows of circular cavities, which are generally empty, but are sometimes filled with calcareous concretions. In a few instances, these hollows occur out of the line of fissure, and entirely penetrate the stratum, being connected below with horizontal channels of the same kind. On the surface, calc-tuff (Kunkur) is very abundant, often adhering to the strata, or investing fragments of the rock.

The same appearances are seen near the diamond mines of Chinoor on the Pennar, where the strata are much disturbed, and basaltic pebbles cover the banks. The only explanation which can be offered of the phenomena in both those distant localities is, that the extrication of gaseous fluids and water from below, had taken place in the lines of fissure, and had dissolved a portion of the limestone, which was again deposited in the great accumulation of tuff and conglomerate so remarkable in these places. That they at all indicate the " argillaceous limestone" to be of freshwater origin, could never be imagined by any who had seen the rock in question, which, wherever it occurs in the south of India, is entirely devoid of fossils†. This supposition is confirmed by the phenomena exhibited at the hot-springs of Urjunah, which rise in the same rock, and where bubbles of carbonic acid are extricated through round holes in the mud covering the bottom of the rivulet, the water of which, being loaded with lime, a calcareous tuff is rapidly deposited.

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* Minute undulations, resembling those formed by the ripple of running water, were observed on this sandstone, in a seam not quite parallel to the line of stratification.

† This assertion may, in the progress of knowledge, be found to be erroneous ; but having carefully looked for fossils during extensive journeys through districts principally composed of this rock, I doubt whether such will be the case. Fossil plants have been reported to be found near Gundycottah ; but these I ascertained to be mere dentritic markings on the surface of the strata.

A gentle elevation, extending three miles to the east of the village of Zynad, is composed of this limestone, and it rises very gradually towards a small conical summit, composed of coarse vesicular basalt, which has broken through and covered the limestone. A portion of this rock appears to have been displaced in a singular manner. A wall of perfectly vertical stratification, about 3 feet thick, projects nearly as much from the general surface, and consists internally of the same limestone, as that which it appears to cut at right angles, while externally it is singularly irregular and altered, being converted into a beautifully crystalline limestone, with quartz minerals.

To the north of this place, as far as the Payne-Gunga river, the country is flat, covered with basaltic soil or rock connected with insulated trap hills, and intermixed with jaspers, resembling those so common near Bangnapilly, and perhaps derived from the argillo-calcareous schists occasionally seen in the water-courses. The pebbles of the Payne-Gunga consist mostly of calcedonies of a reddish colour, and of argillaceous limestone, and they are in many places consolidated into a conglomerate by the calcareous matter with which all the waters of the district abound. In a layer of this conglomerate, projecting from the alluvial soil of which the bank is composed, numerous recent shells are imbedded. The limestone, and its incumbent schists, are seen north of the river, and they abound in springs and streams loaded with lime, which is deposited as calcareous tuff in the water-courses. Masses of the same substance, several feet in height, project from fissures in the rock, or compose conical eminences of white "Kunkur," which are scattered over the black basaltic plains.

Proceeding a little further towards the Pindee hills, in which the principal of these streams takes its rise, sandstone appears on the south bank of a ravine; and on the opposite side, at a lower level, the "argillaceous limestone" so often mentioned, has been raised by some violent forces into irregular gothic arches, overlaid by partially broken but horizontal strata. The spaces within the arches are filled with fragments of the same rock forced from below. Hot springs, having a temperature of 87°, rise through the limestone, and globules of gas escape from round holes in the *débris* and mud covering the bottom of the ravine. On endeavouring to collect a quantity of the gas, there were found to be considerable and irregular intervals between each jet of air.

A recent calcareous sandstone is formed in the bed of the stream, by the *débris* derived from the quartzose sandstone of the southern bank being agglutinated by the carbonate of lime of the springs.

A range of low hills having rounded summits, with conical elevations projecting from their sides, runs in a north-west direction, three quarters of a mile from the hot springs. The cap of these hills, where the Pindee Ghàt passes over them, consists of the argillaceous limestone, and the large slabs of which it is composed, are fissured in various directions, slightly convex upwards; and when taken in the mass, they have an anticlinal dip. On the summit, the strata are horizontal and in several places are remarkably altered, the argillaceous and siliceous ingredients having arranged themselves into a black chert, and a mixture of calcareous matter with streaks of a white or pale blue enamel resembling calcedony. The central parts of these bands are composed of minute quartz crystals; and irregular drusy cavities, coated with amethystine quartz, occur in the blackened flinty portions. There cannot be a clearer indication of the action of heat on a rock of a mixed character than this, even when seen in hand specimens. The whole of the base of the hill is composed of the usual black concentric basalt, the nuclei of which are exceedingly hard and contain much olivine; and to its intrusion the alteration of the limestone, with its separation from the strata below, is, without doubt, to be ascribed.

Many hills composed of concentric basalt are scattered over the neighbouring country, in insulated masses or long ranges rising in terraces, and having flattened summits. The sides of the hills between the terraces are steep, and their outline is well defined; the rock also is black and devoid of vegetation. The terraces occur at very different levels in different hills, rising from the same plain; and their whole appearance indicates that their remarkable form is due to the circumstances which attended their elevation; and that they have not been subjected to any extensive denudation.

About five miles north of the hot springs of Urjunah and four miles south of those of Kair, sandstone caps a gently rising ground, covered with basaltic soil. Near the last-mentioned town, many hot springs rise in the argillaceous limestone, which has been remarkably broken up and altered by the globular basalt protruding through it in different places, in masses several of which are only a few yards in circumference. The limestone is, for the most part, nearly horizontal, but it is occasionally more or less inclined, and, as is usual with this formation, it has no regular direction or line of bearing. In a deep well near the village, the water of which is of the usual temperature, the limestone is unaltered;

but above the principal hot spring, some of the most remarkable effects of igneous action in changing a stratified rock, are exhibited. The principal part of the small hill is a whitish limestone, the stratification of which is obliterated, and the rock projects in irregular masses full of cavities passing deep into the mass of limestone, which is partly crystalline, and in many places mixed or coated with jasper and quartz crystals. Much calcareous tuff (" Kunkur") is associated with these altered rocks, and it fills up many of the cavities; it is also found in the divisions of the nodular basalt, and masses of it, scattered over the surrounding country, are the only remains of springs which have been long closed up. Some portions of the rock had the appearance, on the surface, of a semifused brick, and had assumed something of a regular arrangement, while the centre was composed of the limestone little altered. Large masses of porous scoria also lay about.

The principal springs issue at the foot of the rising ground, where the rock is most remarkably altered. Their temperature (87°) was the same as that of Urjunah, on the other side of the Pindee hills, and it did not vary during the hot and cold months of 1831 and 1833. The water of this and many other springs is said to be equally copious at all seasons, covering the neighbouring country with the richest vegetation, when all beyond is a black and parched waste. On issuing from the rock, the water is sensibly acid, and in one spring, carbonic gas escapes with the water. It is remarkably agreeable to the taste, and sparkles in the glass, as well as where the stream passes over rapids. It contains a little muriate of soda, a minute quantity of sulphates, and much carbonate of lime in solution, which is deposited on boiling, and in the bed of the rivulet, where it has formed considerable masses of rock chiefly composed of the petrified vegetation of the banks. So quickly is this deposit formed near some little falls, that shells appear to be imprisoned and entombed while adhering to the face of the rock; and tufts of grass are encrusted with sediment while their roots are still alive. If any doubt remained as to the nature of the nodular limestone, known in India by the name of " Kunkur," it would be removed by the sight here exhibited of all gradations of this substance actually forming, and varying from pulverulent lime to a crystalline rock. The water is probably derived from a great depth, the springs having, as already stated, the same temperature as those of Urjunah, and not being materially diminished by the failure of the annual rains.

Sandstone forms the surface rock in different directions over the surrounding country, but I had an opportunity of examining it carefully only at Won, eight miles north of Kair, its junction with the limestone being concealed by basaltic soil, mixed with calcedonies, fragments of that rock, schist, and of a coarse puddingstone, which I did not find *in situ.* The hill of Won is composed of sandstone, dipping in all directions from the apex, and varying in colour from white to red and yellow. It contains also ferruginous grains or scales, either in seams or disseminated through its substance. In a fragment of this kind much resembling the cement of the Bangnapilly diamond breccia, a fossil was discovered having a compact structure and deep black colour, and it is probably a portion of a hollow, compressed vegetable, the centre of which is filled with the sandstone. It is the only instance that has come to my knowledge of a fossil being found in the sandstone of Southern India; and as the rock corresponds in geological position and mineralogical characters with the diamond sandstone, the fact is of considerable interest, even if the formations were not found to be continuous, as will be stated hereafter. The specimen is deposited in the Museum of the Asiatic Society of Bengal.

Sandstone, argillaceous limestone, and schist constitute the building-stones of the surrounding country, which is much buried under basalt, and a black alluvial soil containing calcedonies, jaspers, &c. A few miles south of Chicknee,* (where the fossils were again met with,) the red schist found above the limestone south of the Urjunah hot-springs and in various places of the diamond districts of the south, reappears, intermixed with protruding masses of basalt, which have altered it in the most singular manner,—the lime of which it is in part composed, being converted into a fine crystalline mineral, in which the red clay is enveloped or diffused, giving the rock and even hand specimens a very striking appearance. Near Chicknee, the schist rises slightly towards a basaltic ridge, in which the fossiliferous chert is likewise imbedded. The schist is divided into minute rhombs by vertical partings, in which veins of calcareous spar from an eighth to half an inch thick have been formed, and give it a beautiful, reticulated appearance. Lime is found in the schist, and portions of the red clay are enveloped in the crystalline limestone, which contains no magnesia.

The fossils occur on the surface, or are imbedded in nodular basalt over several miles, being found in blocks of indurated clay, chert, and flinty slate. The appearance of the indurated clay is the same as in some of the specimens from the Sichel Hills, but the clay is harder, full of cavities, and in some cases passes into perfect chert, or has waved lines of quartz or opalized matter diffused through the substance of the mass.

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* Fossils were first found at Chicknee by Mr. W. Geddes, May, 1829.

Many Physæ, Paludinæ, and a few Limneæ of the same species as those already noticed, are found in this indurated clay or imperfect chert. Some of them are entirely converted into calcedony; others have the lime replaced by quartz, which is finely crystallized and covers the surface of the convolutions; or the columella only is preserved, passing across an empty cast of the shell. In some cases, however, the structure of the fossil is unaltered, and it effervesces in acids. Flinty slate without organic remains occurs in the neighbourhood of those amorphous masses, and many fragments of the same kind containing large compressed bivalves are scattered about. In one block of this kind, portions of palm wood mineralized by black flint, intersected by fine veins of a light blue opal, (of the same kind as occurs in some of the specimens of fossil wood from Antigua, lately presented to the Society by Mr. Stokes,) was found associated with compressed very thick bivalve shells, probably referable to the same species as those of Munnoor.

Every appearance presented by these rocks indicates the action of the semifluid basalt on the beds of mud and sand, probably derived from the neighbouring sandstones and schists, in which the shells previously existed.

At Hingan-ghàt*, a few miles further to the north, considerable fragments of silicified palms and other plants were found in a black chert lying on the basalt, and similar masses, but without fossils, were imbedded in it. I met with no organic remains to the north of this town, the whole country as far as the city of Nagpoor being covered with a rich black soil, from which insulated basaltic hills with flattened summits rise abruptly.

Of these hills the most remarkable is that of Seetabuldee, which is based on decomposing gneiss and mica slate. To Dr. Voysey's description* I have nothing to add; but as it has been inferred†, that the "flattened summits and long flat outline" of the low ranges connected with this celebrated hill, and forming the eastern part of the great trap district, are composed of basalt having the same stratified appearance as that of other parts of the formation, it is necessary to mention, that they are formed of globular basalt such as has been already described, or of basaltic columns of very regular forms, which diverge from the centre of the hill and incline outwards at an angle of 45° with the horizon, or form a figured pavement on the flat summits.

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* In examining with the microscope sections of some of the silicified wood from the district described, a specimen from the chert of Hingan-ghàt appeared to me to be bone, and Mr. Owen, who has had the kindness to examine it, has ascertained it to belong to a mammiferous animal. He has favoured me with the following note on this important fossil:

"A section of this fossil was prepared sufficiently thin to allow of its being examined by transmitted light under a high magnifying power, when it was found to possess the structure characteristic of bone. Sections of 'Haversian canals,' with their concentric lines, were everywhere present, interspersed with numerous Purkingian cells or corpuscles: the size and disposition of these characteristic parts of the osseous structure agreed with those of the bones of the Mammalia. It was highly satisfactory to find the microscopic test as available in demonstrating the presence of bone, when ordinary characters and the unassisted eye would have left the matter doubtful, as it is in reference to the determination of the teeth."—July, 1839.

Origin of Minerals in Trap Rocks.

The lower part of the hill of Seetabuldee itself exhibits a tendency to columnar structure, caused by horizontal and vertical partings, the sides of which are coated with thin plates of calcedony, and, according to Captain Jenkins‡, of calc spar. These minerals are not confounded with the substance of the basalt, and may be the result of infiltration or sublimation of siliceous and calcareous matters. In no other situation did I meet with an example in which either of these processes would account for the occurrence of the calcedonies, zeolites, calc-spar, &c. found in the amygdaloids and nodular basalt of India. Almost everywhere, calcareous spar is more rare than siliceous minerals, which would not be the case were they derived from infiltration, if we are to interpret the past by the present operations of nature. Wherever I have met with the basalt, and in the neighbourhood of every greenstone dike or insulated mass of that rock, and under every layer of basaltic soil in India, calcareous matter is deposited, and has even occasionally a crystalline structure. In the escarpments of the Mysore ghàts, veins of basalt, not two inches thick, ramify through the granite, and are coated with a compact layer of carbonate of lime. Voysey found the granite in the neighbourhood of the basalt intermixed with calcareous matter, indications of which I have myself seen, in the deposit of tuff on the summit of granitic logging-stones near greenstone. If, then, we suppose infiltration to have deposited the calcedonies, agates, &c., &c., when chemical action is presumed to have been more powerful than at present, a greater number of the cavities would have been filled with lime than with such intractable substances, which is not the case. These are also frequently intermixed with the basalt in a manner which could have been produced only by their being formed simultaneously. I have seen masses of calcedony, passing into a black mineral not to be distinguished from the surrounding basalt. They also occur in the compact nodules where no fluid could have had access, and even in the cavities of the Seetabuldee basalt, lined by an impervious glassy coat. In this rock, likewise, calc spar occurs, penetrated by needle-like crystals of the same substance, invested with a crust of the basalt and connected with each side of the cavity, and resembling chiastolite in structure. It is indeed impossible to conceive how many of the appearances presented by the agates, cornelians, or drusy cavities in calcedony, partially or entirely filled by quartz crystals, or a central mass of calc spar, could be formed in the way supposed, as the first coating of silex would effectually close out the further access of the aqueous solution of that substance; nor could layers so formed, separate into distinct cavities, having both sides covered with quartz crystals, as they are sometimes seen to do. It is, however, only by a careful study of the rocks themselves, that this can be fully understood. I have selected a few specimens to show that the majority, if not all the minerals of the Indian trap rocks, are not formed by infiltration. One of these, perhaps, deserves particular notice; it is a mass of calcedony, 8 or 10 inches in length and 6 or 8 in diameter, of a conical shape, and was found imbedded with its apex downwards between the globular basalt, and impressed with the irregularities of its surface. In another of these specimens the upper part is perfectly flat and smooth, without any impressions of the basalt, and is composed of a thick covering of cacholong, parallel stripes of which appear to indicate the slow cooling of the surface. The centre of the mass is composed of quartz crystals, radiating to the centre, which is occupied by calcareous spar impressing or impressed by the quartz. The mode of its occurrence increases the conviction in my mind, that the only correct theory of the formation of such minerals in trap rocks, is the play of the molecular attractions existing between similar particles of matter. That so eminent an inquirer as Dr. Turner should have asserted that all calcedonies, rock crystals, &c., even when occurring in volcanic rocks, are the result of aqueous infiltration*, I can only account for, by the difficulty of explaining how carbonic acid is retained at high temperatures, in any other way than by supposing a great pressure to have existed at the time the rock was in an ignited state; but of the existence of which, proof is often entirely wanting where crystals of carbonate of lime occur. The phenomena exhibited by the vesicular trap, scoriæ, and porous chert associated with the Indian basaltic and fossiliferous rocks, satisfied me, that at the time of their formation they were subject to no pressure sufficient to retain the carbonic acid of the altered limestones, and of the shells and calc spar inclosed in the geodes; but no other explanation presented itself, till I was informed by Mr. Faraday of his beautiful experiment of exposing carbonate of lime in perfectly dry air to the heat of the oxy-hydrogen blowpipe, without driving off its carbonic acid. In the simple apparatus employed by him to show that the retention of the acid depended on the absence of moisture, no pressure of any consequence could be exerted on the lime. Guy Lussac has lately published some experiments on the effect of aqueous vapour in assisting the escape of carbonic acid from limestone, and concludes, that its agency is trifling*; but as he does not appear to have taken the precaution of drying the atmospheric air by passing it through sulphuric acid, as was done by Mr. Faraday, they cannot be considered as invalidating the beautiful results obtained by the latter. His observation, however, that the water contained in limestones is driven off before the carbonic acid and at a much lower heat, is important, in showing that the calcareous matter in a rock exposed to volcanic action may lose its water before the carbonic acid, and be thus reduced to the state of the carbonate of lime in Mr. Faraday's platinum tube. These facts will assist in explaining the anomalies observed in the fossils of the district above referred to, which often retain their carbonic acid when portions of the rock in which they occur have been fused by the inclosing basalt, while other portions are vesicular from the escape of gaseous matters. The whole phenomena, indeed, would admit of explanation by supposing, what must in fact have occurred, the presence or absence of moisture during the various degrees of heat to which the rocks were exposed in the progress of the eruption, and in the course of cooling. A shell, in one part of a rock, may thus retain its carbonic acid, while in another portion it may be reduced to quick lime, subsequently carried off by the water, leaving only a cast; and a third may be replaced by silica, or the form of its convolutions taken by fine quartz crystals, perhaps derived from silica rendered gelatinous by the lime with which it was ignited†.

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* Asiatic Researches, vol. xviii.

† Geological Transactions, Second Series, vol. 4th, p. 410.

‡ Asiatic Researches, vol. xviii., p. 199.

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* Lecture on the Chemistry of Geology, by Dr. E. Turner, Edin. New Phil. Journal, Oct., 1833.

In stating these views, I venture only to express an opinion forced on me by the phenomena under description, and which appear to explain some of them better than the theory of pressure, which, however useful in removing the prejudices against the igneous origin of the trap rocks, has been injurious in leading geologists to admit too easily the existence of aqueous pressure, or extensive denudations of solid rocks, supposed to have confined the carbonic acid at the time of eruption. No doubt pressure is an efficient agent in some cases*, but not in many to which it has been applied.

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* Annales de Chimie et de Physique, Oct., 1836.

† For a knowledge of the fact, that lime calcined with finely-divided silica, acts like he fixed alkalis in rendering it gelatinous and soluble in weak acids, I am indebted to Capt. Smith of the Madras Engineers, F. R. S.

The trap terminates in the line of section, a few miles to the north of the city of Nagpoor, and is succeeded by a red sandstone, the strata of which are bent, fractured, and converted into a compact quartz rock, at the point of contact with the granite which has burst through it. Within a few hundred yards of the ravine where these phenomena were observed, mica slate occurs, and a little beyond, some hills of gneiss. A bed of granular limestone is quarried at the foot of a conical hill of basalt, in part composed of a scabrous quartzose, and calcareous rock, abounding in drusy cavities, calcedonies and cornelians. Further north, granite veins pass through a much-elevated limestone, varying in colour from red to gray and black, and the stratification of which is nearly obliterated. The gneiss and mica slate forming the neighbouring hills are also penetrated by dykes and masses of granite†. To the north of this district are 50 miles of a wild mountain country, composed of granitic rocks, with trap in the ascents and tops of the passes; the basalt then reappears, and composes great part of the valley of the Nerbudda.

In a direction south-west of Nagpoor, the nodular basalt is the only formation met with as far as Baitool (90 miles), where granitic rocks reappear, but are succeeded by fine-grained sandstones with traces of coal, and penetrated by trap dykes ranging from S.E. to N.W‡. Here, the sandstone rises into mountains, and constitutes what appears to be the continuation of the range forming the division between the valleys of the Taptee and Nerbudda rivers; and "indurated clay," containing casts of the same shells as those of the Sichel range, also occurs.

Before proceeding to notice more particularly the fossils, and the evidence they afford of the geological era of the intrusion of the basalt, it is necessary to make some observations on the Sichel range, and the connexions of the several formations occurring in the district described. The basaltic rocks of Nagpoor and of the country to the south, have been considered by every observer to form the eastern part of the great basaltic formation of Western India, with which it is continuous, and with which it agrees in every particular of general character and mineralogical structure, and in being connected with stratified rocks, which, as far as is yet known, are of the same age. The only difference is, that towards the eastern limits of the formation, the hills are less elevated and the trap breaks through the granite and stratified rocks, while to the west the mountains are, with a few exceptions, entirely composed of basalt from the level of the sea to the loftiest summits.

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* Transactions of the Royal Society of Edinburgh, vol. vi., p. 120.

† Captain Jenkins, in Asiatic Researches, vol. xviii.

‡ Lieuts. Miles and Finnes, Journal of the Asiatic Society of Bengal, Feb., 1834, and Dr. Spilsbury, August, 1834.

Lonar Lake, &c.—The Sichel hills, which have heretofore attracted little attention in a geological point of view, terminate to the west in the neighbourhood of Lonar, near what appears to have been a vast crater in the centre of the great basaltic district. As it is the only instance of a volcanic outburst discovered in this immense Plutonic region, a more detailed account of it than has yet been given to the public, may not be unacceptable*.

It is a nearly circular or oval depression, in a country composed of tabular and nodular basalt, and sloping gently towards it on every side. It is between three and four miles in circumference at the upper margin of the precipitous escarpment which rises from the bottom of the valley about 500 feet. The extent from which the water is collected may be about six miles in circumference, but no measurements were made. Two small streams fall into it from above; one issuing from a pagoda, to which it is carried from the gentle slope behind; and the other passes over a small cliff, (Pl. B.) on which it deposits a considerable quantity of stalactite. The sides of the crater are covered with a forest inhabited by tigers and game; and the bottom is occupied by underwood, a few fields, in the irrigation of which the water of the streams is nearly expended, and by a small lake of salt and bitter, greenish water, surrounded by a muddy shore, and varying in size at different seasons. Many sweet springs issue from the saline mud, and a well is built within its highest level, the water of which stands at the same height as that of the lake, though issuing from a depth of nearly twenty-four feet.

I have carefully examined the water of this well, and that of the small stream at the pagoda above. This last had a specific gravity of 1000·6;

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* Captain Alexander has published a notice of this lake in the Transactions of the Literary Society of Madras, and in the Edinburgh Philosophical Journal; but he must have examined it very cursorily or he would not have overlooked its real nature, and stated it to be unfathomable, when, in fact, the water is everywhere shallow. An extract from a private letter to Mr. Prinsep, and published in his Journal for June 1834, was written before I had myself examined the chemical history of the lake.

and 2000 grains, evaporated at 212°, gave a solid residue of $\frac{7}{10}$ of a grain, the greater part of which consisted of muriate of soda with a little sulphate, and the remainder of carbonate of lime. The water of the well below had nearly the same specific gravity, but contained in 2000 grains, one grain of solid matter, of which $\frac{7}{10}$ of a grain were soluble in water, and contained muriate of soda and a little sulphuric acid and lime; the insoluble part consisted of carbonate of lime. Neither of the waters contained any trace of alkaline carbonates or of magnesia. It is unnecessary to go further into the analysis here, as another bottle of the same water had a higher specific gravity, and contained more lime, a circumstance sufficiently accounted for by the escape of a portion of the carbonic acid from the other specimen The water of the lake is clear, and has no unpleasant smell; but the mud at its bottom is strongly impregnated with sulphuretted hydrogen. In February, 1834, when the specimens were collected, the lake was in no place more than 5 feet in depth of water and mud, but when full it may be eight or ten feet deep in some parts. A layer of salt 2 or 3 inches thick covered the bottom *under the mud*, and when broken up and removed, was found to be composed of a middle plate, with radiating laminæ above, and having a striated appearance below. That obtained by diving and bringing up baskets of the black mud, at a season when there was much more water in the lake*, was also formed under the surface of the mud in lamellar spiculi radiating in every direction†. The salt accumulates slowly, and is collected only once in several years, the quantity having diminished in consequence of the mounds erected above the edge of the crater to regulate the supply of water, having been neglected: but it is evident, from the great beauty of the specimens obtained, that the quality is not affected by this cause. The salt is collected at the end of the dry season, when the water is low; and I observed mounds of the black mud on the banks, covered with an efflorescence of tabular crystals. The salt is used for washing and dying chintzes, &c., and is exported to considerable distances. I imagined that the water of the lake in which such large quantities of salt were deposited, was saturated; but I found its specific gravity to be only 1027·65, a solution of the salt itself obtained from the bottom at the same time being 1148·4; and the water rapidly dissolved the crystals thrown into it. On analysis, the salt was found to consist in 100 parts: of carbonic acid, 38; soda, 40·9; water, 20·6; insoluble matter, ·5, and a trace of a sulphate. This nearly corresponds to the composition of the trona or striated soda from the lakes of Fezzan, examined by Mr. R. Phillips*; but approaches somewhat nearer to the equivalent numbers of the sesquicarbonate established by that analysis, which is to be ascribed to the greater purity of the Louar salt. The water of the lake contained besides, a little potash, muriate of soda 29 grains, sesquicarbonate of soda 4·2 nearly, and sulphate of soda ·1 of a grain in 1000 grains of the water. No lime could be detected in it, nor did I discover any magnesia. These facts confirm Berthollet's theory of the formation of carbonate of soda in the natron lakes of Egypt, viz. that of a mutual decomposition of the muriate of soda and carbonate of lime when in a pasty state.

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* July, 1824.

† The natron of a lake near Maracaybo in South America occurs in the same way, the Indians breaking up the layers of salt with long poles; and then, by diving, they remove it from under a bed of mud which covers it, and they place it in small canoes, as is done at Lonar. Journal of the Royal Institution, vol. i., p. 188.

The striated soda of Fezzan and of this lake, containing half an equivalent more of carbonic acid than can be furnished by carbonate of lime, renders some modification of his theory necessary; and the most probable explanation appears to be, that the carbonic acid by which the lime is held in solution in the mud, furnishes the acid, and perhaps indicates the existence of an unstable sesquicarbonate of that substance; which is not improbable from other facts in the history of the union with that acid. This was suggested by my friend Captain Smith, of the Madras Engineers, and explains the circumstance sufficiently.

Like most points in physical science, these observations have other and more extensive applications than that of affording an explanation of the production of natron in this lake. Carbonate of soda is extensively distributed over the surface of the soil in various countries, more especially in the basaltic portion of Central and Western India, and in the limestone districts of the south; the real relations of which have been a subject of discussion amongst Indian geologists, and inferences unsupported by fact have been drawn from it. In all the places where I have met with it, or of which detailed information has been obtained, muriate of soda and carbonate of lime existed in the soil, and the natron was found on the surface of the moist earth or mud. Near Gundycottah on the banks of the Pennar, common salt is interstratified with the upper schistose strata of the argillaceous limestone on which the sandstone rests; and on the surface of the neighbouring soil, natron, contaminated with much muriate of soda, is collected and used in washing and in glass-making. The salt associated with the limestone, and the water of a saline well dug through it, having the specific gravity of 1002·5, contain common salt and a little sulphate without any carbonate of soda, which is no doubt produced in the same manner as the Lonar salt. I did not ascertain whether it was also a sesquicarbonate, but I have examined a portion of native carbonate of soda from another part of India, with which Mr. Faraday had the kindness to furnish me, and I found it to be composed of a mixture of that salt with muriate of soda and a little sulphate. The same is probably true of the carbonates found in other countries in similar situations*. A specimen, however, procured from the water of a deep well near London, passing through the London clay into the chalk, which I received from Professor Daniell, contained the carbonate; but as the sesquicarbonate is decomposed by a low heat, no inference can be founded on the examination of specimens obtained, as this was, from the boiler of an engine.

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* Journal of the Royal Institution, vol. vii., p. 294.

The absence of Lime in the water of the Lonar Lake is a remarkable circumstance, but easily accounted for, as the sesquicarbonate of soda and the water itself precipitate the sulphate and muriate of lime, notwithstanding the mutual decomposition they undergo when in a semifluid state. The Lake of Ourmia, in Persia, is stated by Dr. Marcet to contain no lime, although of a specific gravity of 1165·07, and abounding in sulphates and muriates. This appeared very remarkable in an inland sea nearly 300 miles in circumference, situated in a volcanic country. On referring to the works of travellers†, it appeared that the streams flowing into it abounded in lime, which is deposited in large quantity in the form of a beautiful travertine. The lake is shallow, and at certain seasons much of it is nearly dry; the water is clear and transparent, but the mud of the bottom is loaded with sulphuretted hydrogen, and thick layers of salt, formed in it under the water, are redissolved on any agitation. No fish can live in it. All these phenomena are exact counterparts of those exhibited at Lonar, but no information is given as to the salt collected from its saline mud, except that Sir John Malcolm states, the salts are bitter and different from those of the sea. I am, therefore, strongly impressed with the conviction, that sesquicarbonate of soda is formed from its waters as at Lonar, and precipitates the lime. Dr. Marcet, however, has given, in the Philosophical Transactions for 1819, the results of an examination of a small quantity of this water, which he states to be as follows:

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* The carbonate of soda formed by the incineration of saline plants in the deserts of Northern India, and by the deflagration of nitrate of soda and charcoal in the south of the Peninsula, must not be confounded with the natron found in the soil.

† Sir John Malcolm's History of Persia; Sir Ker Porter's Travels; Ouseley's Travels; Journal of the Geographical Society, vol. iii. &c.

1.	Precipitate from 500 grains of the water by nitrate of silver	237·0
2.	By nitrate of baryta	66·0
3.	Magnesian precipitate by carbonate of ammonia and phosphate of soda	10·5

and he infers, that although it contains no lime, it yields twenty times as much sulphuric acid and six times as much muriatic acid as sea water does. But Dr. Marcet had only 150 grains of this water to operate on, and merely gives in a tabular form, along with many specimens of sea water, the quantity of precipitate caused by the various reagents; and there is no evidence that the precipitate from muriate of baryta was not, in part, caused by carbonate of soda. It is, at all events, worthy of the inquiry of future travellers[*].

The Lake of Ourmia, like that of Lonar, contains potash, which I did not detect in the springs running into the latter, but its source is no doubt in the decaying (and when I visited it, burning) trees on the surrounding precipices. The sulphuretted hydrogen adhering to the clay has been supposed to be derived from volcanic sources, but I have observed the same phenomenon in the salt water inlets along the Indian coast, wherever the bottom contained argillaceous and carbonaceous matter; and it even goes so far as to form considerable quantities of sulphur and, I have reason to believe, sulphuric acid, although on this point the proof is defective. The effect is to be ascribed to the decomposition of the sulphates of the water by the carbon; and the clay probably only prevents its passing off into the air or mixing with the water, by the power of adhesion. Similar actions have gone on in former times in the alluvium on which the city of Madras stands, and probably in more ancient deposits[†].

The ancient crater of Lonar seems never to have been an active eruptive vent, as no scoriæ or lava currents can be traced around its margin, which is too distinct and unaltered to admit of any probability of these having been subsequently removed by denudation. A certain degree of forcible elevation was sustained by the margin of the lake, when the explosion or subsidence happened from which the great depression took its origin.

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[*] If a carbonate exists in the water, it must be of the same composition as that of Fezzan, Maracaybo, and Lonar, as the carbonate would precipitate the magnesian salt, which the sesquicarbonate would not.

[†] No sulphuretted hydrogen can be detected in the water of the springs running into the lake. The hot spring of Anhoni Simhoni, in the sandstone and basaltic district between the valley of Berar and the Nerbudda, I have found to contain sulphuretted hydrogen and muriate of soda, without lime.

From Lonar the basaltic district extends to the south as far as Beder; to the west. 200 miles to Bombay; and northward, to the banks of the Nerbudda, near the ancient cities of Indoor and Mhysir, reported to have been buried at a remote period under volcanic eruptions. To the east, the great basaltic country of Berar extends as far as Nagpoor; and the Sichel range passes in a S. E. by E. direction to the confluence of the Wurdah and Godavery, and towards the eastern ghâts. Hot springs and streams loaded with carbonate of lime, occur along the line of elevation of these mountains at Mahoor, Urjunah, Kair, Byorah, and at Badrachellum, a short distance above the pass through which the Godavery reaches the alluvial plains of the coast. The spring of Byorah is surrounded by sandstone and limestone rocks, and carbonic acid escapes with the water, which has a temperature of 110° and holds lime in solution*. That of Badrachellum, which rises in the sandy bed of the Godavery, has a temperature of 140°, and contains sulphuretted hydrogen, also sulphates and muriates of soda and lime. A sandstone resembling the cement of the Bangnapilly diamond breccia and the rock of Won, protrudes from the sandy bed of the river near the spring; and granite, basalt, and a red schist resembling that so common in the diamond districts, occur in the neighbourhood; diamonds also are occasionally found. Other hot springs are reported to exist in this line of elevation; but that wild and little-known country, far removed from the residence of any European, must long remain in a great measure unexplored.

The facts stated in the preceding pages prove that the basaltic rocks, by which so much of Western and Central India are covered, are more recent than the sandstone and argillaceous limestone of the basins of the Pennar, Kistnah, Godavery, and of the mountains south of the Nerbudda; and that, notwithstanding the frequent occurrence of these rocks in a horizontal position, they have been subjected to violent operations, which have in many instances elevated the strata and remarkably altered the rocks themselves. It also appears, from observations made on the borders of the trap districts, and in other places where the primary rocks and the sandstones and limestones are not entirely concealed, that the basalt has burst forth from numerous fractures in these formations, probably simultaneously, although often forming insulated masses. It is possible, that more than one period of eruptive violence may have occurred between the era of the formation of the greenstone dykes, so common in the granitic districts, and the conclusion of the eruptions by which the fossils were entombed; but at present there is no proof of such having been the case; and all observers have considered the eruptions to have been contemporaneous; an opinion, to a certain extent, confirmed by the occurrence of the same fossils in very distant localities.

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* Journal of the Asiatic Society of Bengal, vol. ii., p. 397.

The sandstone and argillaceous limestone I have myself traced, from the neighbourhood of Nagpoor nearly to the junction of the Wurdah with the Godavery, bearing the same characters as in the vicinity of the fossil beds; and I have collected specimens of the same rocks at various places between this and Badrachellum and the diamond mines in the neighbourhood of the Kistnah. This tract, for 250 miles, is nearly an uninterrupted forest, and presents many difficulties in the investigation of its geological structure. Trap rocks and basaltic soil occur in many parts of the course of the Godavery, and granite of the usual character is occasionally met with. Dr. Voysey, who investigated great part of it with his usual accuracy, describes the sandstone as constituting a range of mountains 60 miles in extent, to the north-west of Badrachellum; and the surface rock 20 miles south of Ellore (near the alluvial plains of the Kistnah and the diamond mines), also at Mungapett on the Godavery, where I found silicified wood resembling that of Pondicherry*. Fossil wood was also seen by Mr. Geddes strewed over the country N.W. of this point, towards the junction with the Wurdah. Where the sandstone of the Godavery meets the granite to the west, Dr. Voysey states that it can hardly be recognised as the same rock, consisting of a conglomerate containing quartz, felspar, and rounded pieces of granite resembling that of the eastern ghâts. The argillaceous limestone occurs in the same district, and is more widely distributed than Dr. Voysey supposed. He found it at an elevation of 2600 feet above the sea, and exhibiting marks of great disturbance, dipping to the S.E., and at the summits of the hills intermixed with quartz rock†. Dr. Voysey considers these formations at the lower part of the Godavery, to be the same as those of the Kistnah and Pennar; and in this opinion I fully coincide, although I have found the continuity of the sandstone and argillaceous limestone to be interrupted by a narrow band of granite, extending from the delta of the Kistnah to the granitic platform of the Deckan. Some of the hills, however, have caps of sandstone. In the present state of our knowledge, it is difficult to form any correct notion as to the dip and direction of these rocks. Indications of derangement and elevation by the granite are, however, sufficiently apparent.

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* Journal of the Asiatic Society, vol. ii., p. 402. The tenor of Dr. Voysey's observations in this place seem to show that he considered the "clay slate," in which he included the sandstone, to belong to the same formation as the limestone; a conclusion I had formed before meeting with his paper, and which has not been expressly stated in any of his writings yet given to the public.

† The structure of the wood is beautifully preserved: it is coniferous. June 21, 1839.

Sandstones and schists of the same characters, and associated with the same rocks, are also extensively distributed along the great tributaries of the Kistnah, in the southern Mahratta country, near the western ghàts, and a little to the south of the part of the basaltic district described by Colonel Sykes (Geol. Trans., 2d Series, vol. IV.). The limits of this part of the formations have been but imperfectly traced. According to Dr. Christie's observations and my own, they are the same as those of the Cuddapah district*. The occurrence of sandstones and stratified limestones in this situation, is a fact of great importance, which has escaped the notice of those, who have speculated on the period of elevation of the great mountain chains of the peninsula. It was for this reason, that I selected the line of section from Madras to Atchera, on the western coast, within the limits assigned by Colonel Sykes to the basalt, and near to which I discovered the sandstone *below* the escarpment of the western ghàts. (Plate, Section 2). In the pagoda of the town, I observed several quartzose sandstone pillars; and I discovered the rock itself forming a small range of hills to the south of the town, and dipping at a considerable angle to the N.W. The stone is similar to that of the hills, near the Chinoor diamond mines. The rock at the entrance of the inlet is laterite, having the appearance of horizontal stratification; and there are some indications of trap below it; but of this I could not obtain positive evidence. Colonel Sykes, however, states that the basalt occurs a little to the south at Malwan; and I found it at Colter, and other places to the north, underlying the laterite, at the foot and on the escarpments of the hills. These facts are sufficient to show, that the elevation of the western ghàts in this part of their course, was posterior to the deposition of the sandstones, which, for the present, must be considered as contemporaneous over all the districts described. I am aware of the uncertain nature of mineralogical characters, as characterizing different formations; but in rocks exhibiting such remarkable appearances and relations over such extensive areas, and when no organic remains exist in them, I do not think it wrong, to place some confidence in the evidence they afford, more particularly in the south of India, where the rapid changes of formations, so common in Europe, are quite unknown.

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* Edinburgh-New Philosophical Journal, 1828 and 1829.

The speculations of Elie de Beaumont on the age of these mountains is founded on negative evidence and analogies which appear to me to have little weight; nor can I consider the remarks of Dr. Benza, founded on his excellent researches on the geology of the Neilgherry mountains, as more conclusive. The non-occurrence of stratified rocks and of organic remains in a high granitic table land, affords no proof that these mountains have not been recently elevated; and the plentiful occurrence of ferruginous sandstone, containing brown coal, lignite, and mineral copal, at the foot of the Travancore mountains, show that these inferences have been too hastily drawn, when such gigantic generalizations were to be established.

AGE OF THE DIAMOND SANDSTONE AND ARGILLACEOUS LIMESTONE.

With regard to the age of the diamond sandstone and argillaceous limestones, my own conviction is, that they belong to the more ancient secondary, or even transition rocks; an opinion, which is not at all contradicted by their frequent occurrence in horizontal strata, as they could not have been deposited in the situations in which they are now found. The facts I have stated, will enable others to estimate the correctness of an impression founded on the structure, geological relations, and occasional nearly vertical position of the strata. On this subject, I would express no decided opinion, but recommend an examination of the junction of these formations with the stratified and unstratified primary rocks, with a view to this question.

The sandstones and limestones of Bundlecund and Malwa correspond in many particulars with those of the south of India, and have been considered by all writers as belonging to the same formations. The sandstone, Major Franklin considers to be the same as the saliferous sandstone of England*; to which it has been objected, that the salt diffused through the soil of Bundlecund may not be derived from this source, as it has never been discovered in that rock. I have also ascertained that salt occurs in all the formations of India, from granite to recent alluvium. I have, indeed, never met with a saline spring in the sandstone, but this I consider to be accidental, that rock being generally placed in inaccessible situations. I have, however, found thin seams of salt, interstratified with the upper schistose layers of the argillaceous limestone, in the immediate neighbourhood of a cliff of sandstone 300 feet in height, between the lower beds of which a similar schist was interposed A more important objection to Major Franklin's opinion of the diamond sandstones belonging to the new red sandstone is, that in the peninsula, this sandstone, throughout 800 miles of latitude, and half as much of longitude, is *superior* to the limestone he has called "Lias." Nor can I find sufficient proof in his memoirs, or in other papers on the country between the Nerbudda and the Ganges, that this limestone reposes directly on the sandstone: and it is evident, that no inference can be founded on its occurrence at a higher level in a country so much altered by denudation and the intrusion of eruptive rocks. But should it be hereafter found, that the limestone in certain parts of Bundlecund does actually occupy a higher geological position, the fact would not be conclusive against the diamond sandstones of the north and south, belonging (as every thing indicates) to the same formation. I am indeed of opinion, that the argillaceous limestone and the sandstone constitute only one formation, although I do not think that they should be spoken of as such in the present state of our knowledge. The basalt which has broken up and penetrated these rocks to the north and south of the Nerbudda, is connected with the same system of trap rocks, and was probably erupted at a period much more recent than either of those to which the sandstones and limestones have been referred.

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* Geol. Trans., 2nd Series, vol. iii., Part I.

Inferences respecting the Freshwater Fossils.

On the evidence on this subject afforded by the fossils imbedded in or covered by the basalt, I shall now make a few observations. For the descriptions of the shells, I am indebted to Mr. J. De Carle Sowerby*.

These fossils all belong to freshwater genera, and to species which have not yet been discovered recent. I have not been able to obtain the seeds of Asiatic *Charæ*, nor the valves of any *Cypris* inhabiting the fresh waters of India. The shells, however, all differ from those inhabiting the rivers of the neighbouring country, as far as Mr. Sowerby and myself could judge, by comparing them with a collection of recent shells, which I made during a residence of several years at Nagpoor; nor do I think it possible that any of the larger shells could have escaped my notice, did they still inhabit the northern branches of the Godavery. Colonel Sykes, also, had the kindness to allow me to examine a collection of recent shells made by him near the western ghats, consisting of the same species as those of the Berar valley, and they are of course different from the fossils. I also failed to detect amongst them any of the shells contained in a large collection of recent land and freshwater Testacea from Bengal, presented to the Zoological Society by Mr. Benson. It may therefore be inferred, that the fossils do not belong to recent species.

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* See Plate, and Description.

Gyrogonites have not yet been observed in any deposit more ancient than the freshwater formations of the basin of Paris. Cyprides occur in the tertiary strata, and in the Weald clay below the chalk, and perhaps in the Birdiehouse limestone of the Edinburgh coal-field. Of the other five genera discovered in these fossil beds, two have hitherto been found only recent or in tertiary deposits, viz. *Limnea* and *Physa*; and the best characterized specimens of some of the others are referable to the same period. It is therefore extremely probable, that the basalt in which these fossils are imbedded, and which has altered the rocks in which they occur, belongs to the tertiary epoch; but to which period, I fear we have not the means of forming any decided opinion. Though none of the species are recent, yet they are too few and in too ruinous a state to admit of any general conclusions; although, from the very great number of individuals collected in various localities, without adding any fresh species, it is probable that nearly the whole which exist have been procured. But when the vast extent of the country occupied by the basalt is considered, and that a still greater tract was broken up or disturbed at the time of its eruption, it will not appear improbable, that a rule, founded on the disappearance of marine shells in districts exposed to no such extensive causes of destruction of animal life, should not apply.

In the preceding pages, I have described the fossils discovered by Mr. Geddes and myself in various parts of the Sichel mountains, and the Valley of Berar, extending through the great trap district for 140 miles; and I shall now shortly refer to other localities at great distances from each other, where the same fossils have been found in similar rocks, buried under the basalt.

OTHER DISTRICTS OF INDIA IN WHICH SIMILAR FRESHWATER SHELLS HAVE BEEN FOUND.

Dr. Spilsbury discovered, eighteen miles from Jubalpoor, in an undulating plain studded with irregular masses of trap, blocks of "indurated clay," containing casts of fossil shells, for the most part siliceous, and resembling those discovered by Dr. Voysey in the Gawilghur range*. At

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* Journal of the Asiatic Society of Bengal, vol. ii., p. 205.

Saugor, nearly 100 miles to the north-west, reversed shells, stated to be exactly the same as those of Jubalpoor, were discovered by Dr. Spry in a bed of limestone, entirely surrounded by an amphitheatre of trap hills, in which a lower range of compact sandstone is included*. This fossiliferous limestone is covered by 17 feet of basalt, and rests on a coarse siliceous grit, under which basalt is again met with. In the same neighbourhood fine specimens of silicified palms are found. Jubalpoor and Saugor are situated to the north of the Nerbudda, in the great Vindya range; and in the same district fossil bones of Mammalia occur in limestone capped by basalt. The drawings of the shells differ a little from each other†, but the fossils are stated to be the same; and, as far as Mr. Sowerby could judge, they do not differ from the *Physa Prinsepii*. The similarity was more obvious in other specimens left in India, and I have no doubt of their being the same. It is, however, desirable that the specimens themselves, in the Museum of the Asiatic Society of Bengal, should be compared, that the connexion of the northern and southern portions of the trap formation may be placed beyond a doubt. South of the Nerbudda, fossils are again met with in the mountainous country, north of the sources of the Taptee, at a place called Jirpah, near to which trap hills have broken through the sandstone. Dr. Voysey, in speaking of the heat of the steel furnaces of Neermul, notices the occurrence of an "indurated clay" containing fossils at this place, but he gives no further information regarding them‡. In a small specimen of this rock, Mr. Sowerby recognized the *Paludina Deccanensis*, and a portion of a larger shell, probably the *Physa Prinsepii;* and the matrix is the same as the fossiliferous "indurated clay" from Gawilghur; it also much resembles many of the varieties of chert in which the Berar fossils are found. The third range of hills has been described by Dr. Voysey under the name of the Gawilghur Mountains, and it forms a very remarkable feature in the physical geography of Central India. In this lofty basaltic range, Dr. Voysey discovered fossil shells, the situation of which he has accurately described§; but as his account of them, has been so far misunderstood, as to induce Mr. Conybeare to state that they occur in "lias-like beds‖," and Colonel Sykes in a recent deposit[*], it is necessary to mention that they are found in mountains in great part composed of basalt resembling that of the Giant's Causeway, but containing, more frequently, crystals of olivine, of basaltic hornblende, and carbonate of lime. This rock passes into a wacké, having every variety of structure and induration known amongst trap rocks, or into what has been called stratified basalt, from the parallelism of its planes, "the summits of many of the ravines presenting a continued stratum for many thousand yards[†]."

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* Journal of the Asiatic Society, pp. 376, 639.

† Ibid., p. 583, Plate 20.

‡ Ibid., vol. i., p. 217.

§ Asiatic Researches, vol. xviii., p. 187.

‖ Report to the British Association, 1832.

Ascending from the Taptee river, Dr. Voysey[‡] observed a group of basaltic columns, and near the summit of the flat table-land of Jillan, he entered a pass presenting a perpendicular section, above the road, of 30 feet, and below it, a rapid descent of between 40 and 50. The lower part of the section, as well as the pathway, is composed of wacké, and "lying on it, is a stratum of earthy clay of different degrees of induration, 20 yards in length and about 2 feet thick, containing a great number of entire and broken shells," which are much compressed, and do not effervesce with acids. Some of them completely commix with the matrix. This bed of clay possesses all the characters of a stratum, which Dr. Voysey says, seems to have been depressed by an overlying mass, 15 feet thick, of the nodular basalt or wacké so common in these hills. The vertical fissures, which are so "remarkable in trap rocks, are prolonged from both the upper and lower rocks, into the shelly stratum, although there is no intermixture of substance." The stone in which these fossils occur, is similar to that of Jirpah, and of many of the specimens from the Sichel range and the valley of Berar; and the casts and fragments of the shells resemble those of the Paludinæ and other shells of that district. Between these mountains and the Sichel hills, the great valley of Berar is included, but the two ranges closely correspond in the nature of the soil and rocks, and in their fossiliferous beds. They are not, however, exactly parallel; nor do I think, that we are justified in classing them with the Vindya range to the north of the Nerbudda, or with the range which separates the valley of that river from the valley of the Taptee.

It is evident, from the same fossils being found in all these ranges, several hundred miles distant from each other, and from the same secondary rocks being broken up and altered, that the basalt of which they are principally composed was, in part at least, erupted at the same time;

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[*] Geol. Trans., 2d Series, vol. iv., p. 426.

[†] Dr. Voysey, Asiatic Researches, vol. xviii., p. 127.

[‡] Asiatic Researches, vol. xviii., p. 192, and Journal of the Asiatic Society of Bengal, vol. ii., p. 304.

and that the western and eastern ghàts must have partaken in this great movement.

Shells, probably of the same genera, were also found by Dr. Voysey in the insulated basaltic hills of Medcondah* and Sivalingapah, which rest on the granite of the Deckan, south of the Godavery, and are probably connected with the southern part of the great trap district, and the hills of Bicknor Pett and Nugger shown in Section 1. The fossils are imbedded in the basalt, in a siliceous rock containing lime, and corresponding in specific gravity, chemical composition, and appearance to the fossiliferous cherts of the Nirmul Hills. Sivalingapah lies considerably to the west, but nearly in the same latitude as Nirmul.

The only other locality where fossil shells have yet been discovered, within or near the great basaltic district, is five miles south of Rajahmundry, a large town on the Godavery, a little above the alluvial plains of its Delta†. They occur in some small hills ranging nearly W. and E., and composed of conglomerate and red sandstone supporting wacké, overlaid by limestone containing shells, which is again covered by basalt. The shells are in the best condition in the upper part of the limestone; of many only the impressions remain, but the oysters, which are the most abundant, are well preserved. The basalt and some specimens of the chert, jaspers, &c., from these hills, presented to me by Dr. Benza, resemble the varieties found with the freshwater shells of the Sichel range, and the hills in which they occur having the same direction, are probably connected with the eastern termination of that range. They are evidently associated with the sandstones of the diamond districts [illegible] the north of the Kistnah, and with the continuation of the eastern ghàts; thus confirming the opinion above expressed, of these mountains being of more modern elevation than is supposed by some geologists. It is impossible to separate the western ghàts from the eastern in any theory that can be formed, as they diverge from the same point, support the same table-lands and the same stratified rocks; and where these mountains meet at the Neilgherry Hills, the hornblende schist has been noticed by Dr. Benza to dip in opposite directions from the eastern and western mountains.

In the Journal of the Asiatic Society of Bengal, vol. iv., p. 565, and our Plate, fossil shells are figured, which bear considerable resemblance to some specimens of Unio from the Sichel Hills, but not sufficiently to identify them. They form part of the Dadapoor collection of Sub-Himalayan fossils, so ably investigated by Lieuts. Baker and Durand, and are stated by Mr. Prinsep, in a note, to be identical with specimens collected by Colonel Burney with the bones of the Mastodon, &c. in Ava. He adds, that they probably belong to the large and thick species of *Cyrena* noticed by Professor Buckland as occurring in a blue and marly clay near the locality of the fossil bones collected by Mr. Crawford (Geol. Trans., 2nd Series, vol. v.) ; but I found the specimens of these shells in the Society's collection, to differ both from those of the Sub-Himalayahs and of Central India.

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* In a specimen of this chert in the Geological Society's Museum, I have found a gyrogonite of the same kind as those of Nirmul, and halves of a species of *Cypris* associated with shells. June 24, 1839.

† Dr. Benza on the Neilgherries, Journal of the Asiatic Society of Bengal, p. 435., Aug., 1835.

Mr. Pentland, in the same volume of the Geological Transactions, makes the following observations on Indian tertiary deposits : "How far "the same formation may be prolonged in a southerly direction along the "peninsulas of Malacca and of Hindoostan it is impossible to say ; al"though we possess proofs of its existence at Madras, where it contains "the same species of shells as on the Brahma-putra, and at Pondicherry, "where it envelopes the great masses of silicified wood found near that "city." (p. 394). The formation on which Madras stands is, however, erroneously referred to the tertiary epoch, being a recent alluvium, accumulated by the joint action of the rivers and breakers, and containing the same shells as now inhabit the mud of the salt-water inlets and sea-shore of the Carnatic.

With regard to the age of the silicified wood of Pondicherry, no facts have yet been ascertained which can justify any conclusion. It is, however, to be hoped, that a gentleman familiarly acquainted with the tertiary and volcanic rocks of Greece and Italy, will soon communicate positive information regarding the geological relations of the sandstones containing the silicified trees and the fossil shells*, the conical hollows, obsidians, and other indications of volcanic action said to exist in that neighbourhood.

RELATIVE AGE OF THE LATERITE AND TRAP.

I shall conclude this paper by one or two remarks on the relative age of the Laterite and Trap. Dr. Babington† and Dr. Christie had observed this rock, both below and above the ghàts in the latitudes of Seringapatam and Goa, and I have traced it in the deep and narrow valleys of Coorg, at various heights, from the level of the sea to several thousand feet above it; but as in all those places it rests on syenite or other granitic rocks, from the decomposition of which, *in situ*, there is much reason to suppose that this remarkable formation is derived, no inference as to its age can be drawn from these facts. At Colter, however, and other places on the coast of the great basaltic district, it rests on the basalt, forming the summits of the hills, or an external layer over the trap which constitutes the body of the hill. This superposition is exhibited in ravines passing through the laterite, or where that rock has thinned off so much, that it can be separated from the basalt below, which has most commonly a stratified arrangement, often highly inclined and parallel to the precipitous face of the hill. It has also been observed above the ghàts, and in the table-land of the Deckan, between the Godavery and Manjera rivers, resting on basalt; it is therefore probable, that the trap has been protruded from below since the laterite assumed its present form. It would be improper, in this place, to enter into any details regarding a formation which extends over much of the Malay peninsula, Ceylon, the coasts of Coromandel and Malabar, and Central India. In different portions of these vast countries, several varieties of this rock are met with, well deserving of attention, yet its general character and composition is the same over 30 degrees of longitude and 20 of latitude, and nowhere is any proof to be found of its being of volcanic origin*, or the equivalent of certain European rocks, as supposed by Elie de Beaumont. Under the name of laterite, however, very different rocks have been included; such as the ferruginous clays and sandy beds underlying the alluvium of the Irawady, near Rangoon, and a ferruginous conglomerate now forming in many places from decomposed and reconsolidated laterite or syenite, and containing fragments of granite, and occasionally enveloping a recent land shell.

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* The shells I have seen differ from those of Central India.

† Geol. Trans., 1st Series, vol. v., p. 329.

Besides these, a rock, apparently of igneous origin, has been occasionally confounded with laterite, and in the diamond districts is known to the natives by the same name as is applied to that rock in the Mysore. The thinner strata of the diamond sandstone of the Pennar have been observed to be bent in a remarkable manner by the intrusion of this rock; and in other instances it had apparently escaped in a semifluid state between the joints of the larger tables, carrying with it fragments of the sandstone, whose angles are so well defined, that I thought I could trace the very spot from which they had been broken off. Notwithstanding these appearances, the character of the rock differed so much from any varieties of basalt I had then seen in India, that I hesitated about referring it to the trap family, till I had seen varieties of a red wacké much resembling it, constituting part of the basaltic mountains of the island of Salsette. It is in a substance of this kind, interstratified with sandstone, that Tavernier describes the diamond mines of Beejapoor to have been worked in former times. The transitory nature of the political divisions of this part of India, and the decay or desertion of many towns and villages, have hitherto prevented the identification of these mines; but enough has been said to show the importance of caution in reasoning on individual facts, relative to one of the most singular and extensive formations anywhere to be found.

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* Calder, Asiatic Researches, vol. xviii. Conybeare, Report to British Association.

Note.

The freshwater shells described in the preceding pages, must have inhabited sheets of fresh water of which no traces can now be discovered, in the configuration of the mountainous tracts, in which they for the most part occur. No natural lakes exist in these districts, nor could shells have accumulated in such quantity in rivers similar to those which now intersect the country. It may, however, be supposed that the sandstone and limestone rocks of Berar had once a position similar to that which the same rocks now occupy in the basins of the Kistnah and Pennar. Voysey describes these rivers as passing through the Nulla-Mulla range by gaps or fissures " which have been produced by some great con" vulsion, which at the same time that it formed the beds of these rivers, " gave passage to the accumulated waters of some vast lakes situated " near the outlets." " The tortuous course of the Kistnah is bounded " for upwards of 70 miles by lofty and precipitous banks, which in some " places rise 1000 feet above its level, the opposite sides of the chasm " corresponding in an exact manner. Ravines of this description are not " unfrequent all over the range, and the exact correspondence of their " salient and re-entering angles, together with the abruptness of their " origin, totally preclude the supposition of their being hollowed out " by the action of running water*." Such seems also to have been the case, where the Pennar passes through a narrow gorge in the Gundicottah sandstone hills. Through the upper part of its course, this river flows over a flat country covered with alluvial soil, at right angles to the hills; but it finds an exit through them, by a fracture in the wall which in former times had apparently dammed up its waters. The strata have been much disturbed, probably by the eruption of the basalt, which is seen at the foot of the sandstone hills on the opposite side of the valley, from which the Gundicottah range appears to have been separated. Plate, Section 2d. It should, however, be stated, that ravines formed in this sandstone, by the action of the streams now flowing in them, exhibit abrupt precipices, the opposite sides of which correspond to each other as Voysey has described.

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* Asiatic Researches, vol. xv., p. 123, 124.

The sections accompanying this paper were constructed by Captain Smith, of the Madras Engineers, F. R. S., from information contained in my notes made during several journeys in the lines represented, and from some published papers. The information is by no means complete, but, I believe, it will be found to be correct as far as it goes. In consequence of the great length of the lines to be represented, and the comparatively moderate height of the hills, it would have been impossible to have given the different formations of sufficient size to have been seen in a distinct manner without great distortion of the strata, had the whole distance been represented. Breaks, therefore, have been introduced, representing the continuance of the same rock for the number of miles specified in each instance. In the Baulpilly valley and in some other localities (Sect. 2) the summits of the hills are almost inaccessible, and it has consequently been impossible to represent them as they occur in the exact line of section. I have therefore been content to exhibit the strata as they occur at their bases, with the exception of a few of the hills which have been more carefully examined, and which correspond in appearance to those which are as yet unexplored.

Section 1st passes from the Bangnapilly diamond mines to the valley of the Nerbudda, with the view of connecting Section No. 1, across the peninsula, with a line running north and south through its centre ; and which might easily be continued to the Himalayah mountains to the north and Ceylon to the south.—*Transactions of the Geological Society of London, Second Series, vol. 5, part 3, pp. 537-575.*

VIII.—*On the Entomology of the Himalayas and of India.—By the* Rev F. W. Hope, F.R.S., F.L.S., *&c., President of the Entomological Society of London.**

It may by some be considered a proof of presumption, that any individual should undertake to describe the entomo-geographical character of a country which he has never visited; and bold, I am willing to allow, is the attempt to embrace, in my views, not only the distribution of Insects in the Himalayas, but those also of the whole Continent of India and its adjacent islands. Possessing, however, one of the richest Cabinets of Oriental Entomology to be found in this or any other country, the major part of the species collected at Calcutta, Madras, Poona, and Singapore, and in the islands of Java and Ceylon; and through the kindness of my friends, the late lamented General Hardwicke, Colonels Sykes and Whitehill, Captains Law, Smee, and Smith, having access to their rich and extensive collections from Nepal, Bombay, and the Deccan; I may be enabled, perhaps, from such a mass of materials, to offer some new facts respecting the geographical distribution of Insects, a subject apparently little studied, and certainly not sufficiently appreciated. It is, indeed, with diffidence that I undertake a task beset on all sides with difficulties; and before I enter on it, I claim the indulgence of my readers, and solicit them to regard the present attempt merely as an outline sketch, which can afterwards be filled up with greater accuracy, as our acquaintance with the nature of the soil, and the forms of animal and vegetable life belonging to the East, become better known. The entomological character of a country is particularly influenced by three things; first, by its temperature; secondly, by its vegetation; and, lastly, by its soil; and, perhaps, a few remarks on these subjects (relating chiefly to the Eastern world) may not here be deemed out of place, before entering more fully into the entomology of the Himalayas and of India.

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* The Author has to apologize to the Rev. Mr. Hope and to his readers for the long delay which has occurred in the publishing of this valuable Paper, written for him in 1834, and which has been in type for a considerable time. The Insects of the Author's collection which Mr. Hope has described, were collected in the neighbourhood of Saharunpore, in the valleys of the Himalayas, and on the mountains in the neighbourhood of Mussooree, at 6,500 feet of an elevation in 30° of N. latitude. The reader will observe that many of the desiderata required by Mr. H. on temperature and vegetation, are detailed throughout the "Illustrations," and he cannot fail to be struck with the remarkable coincidence in opinion, respecting the distribution of Insects as given by Mr. Hope, with that of the Author on the geographical distribution of the Flora of the plains and mountains of India.—J. F. R.

INFLUENCE OF TEMPERATURE AND OF MOISTURE.

In those regions of the world where we find a multiplicity of genera of animals, united with a prolificness of species, we may naturally imagine that circumstances are admirably suited to their existence; and, on the contrary, where we find a small number of genera, and in many instances a diminutive form, and a paucity of individuals, we arrive at an opposite conclusion. Now, if we search for the cause of these discrepancies, we shall find it to depend in a great measure on the influence of temperature. Let us examine, then, in what portion of the globe a superfecundity of organized life exists. Certainly not at the poles, or even in the temperate zones; to the tropical and equatorial regions we must next proceed, and it is there, in those warmer districts of the earth that we find the energies of life more early developed, and vigour and productiveness seem the characteristics of the clime. These remarks apply not less to animal than to vegetable life, for no where do the Herbivora abound more than in warm regions, and no where do we meet with more luxuriance of foliage, or a greater exuberance of arboreous vegetation, than within the tropics. As we recede from the equator, and approximate to the poles, temperature gradually diminishes; and probably nearly in the same proportion as heat decreases, so shall we find the decrease of animal and vegetable species, till we arrive at that degree of cold where vegetation is stunted, circulation languid, animation becomes suspended, and existence is scarcely tenable, if not actually destroyed.

To obviate the effects occasioned by a low temperature, some animals burrow in the earth, and pass the winter in inactivity and torpor; others again, gifted with extraordinary locomotive powers, migrate into milder regions in quest of food, which the rigour of a brumal season and a northern climate has rendered precarious. It appears to me an observation worthy of attention, that at the very period the migratory birds visit us, Insects are already teeming into life, while vegetation has arrived at a state of forwardness sufficient to support, as it were, the expected increase of animal beings. We infer, then, that as vegetation is apparently regulated and influenced by temperature, so animalization is in a measure dependent on vegetation as a secondary cause. It may naturally be expected, in a gigantic country like India, whose superficial area is nearly one million and a half of miles in extent, that great diversities of climate will be found; and when we take into our consideration the altitude of its mountains, surpassing in grandeur the Andes of the American world, we may expect every gradation of temperature which can occur, from the intense cold of the eternally snow-capped height, to the baneful heat of the tropical valley. The elevation of the land above the ocean, the height and direction of its mountain ranges promoting or checking radiation, its mighty rivers and interminable jungles, its soil, strata, and arid deserts, absorbing and radiating heat, exert their varied influences, and modify the temperature of that extensive Continent; and yet, admitting thus much, I cannot help stating an opinion, that according to the extent of the country, no other portion of the globe enjoys a more general and equable uniformity of temperature than India. This may satisfactorily be proved, provided we take as the basis of our argument the wide range of region, over which not individual species, but whole genera of Insects extend, and the general uniformity of Oriental vegetation. Before dismissing the important subject of temperature, I wish to offer a few remarks on the variation of heat and cold throughout the summers and winters in the Himalayas and in India. In the former Dr. Royle states, in his admirable pages, that the Flora of the Himalayas in the spring and summer of the year resembles that of Europe, while in the rainy season it becomes intermixed with tropic-like vegetation; and hence there is a certain admixture of genera belonging to temperate and tropical climes. The change of temperature and of moisture producing a new vegetation, exercises a corresponding influence over the distribution of Insects throughout the same country; and consequently we have reason to expect, as will afterwards appear in my remarks, that its entomological character is also twofold, uniting in itself that of both zones. This intermingling of genera of tropical and temperate regions will ever probably be found more perceptible in the rainy season, in advancing from the valley to the mountain height; and perhaps we ought to know the results of the following researches, before we attempt to arrive at any conclusion respecting the distribution of animal groups in the Himalayas or in India. I would therefore suggest to future travellers in these magnificent regions, first, to endeavour to ascertain the differences of climate, and the causes which affect its temperature; secondly, to find out the average limit to which tropical forms extend, to state where they most abound, where begin to lessen, and finally terminate; thirdly, to note in what proportions the genera of tropical and temperate climes are intermingled; fourthly, at what altitude temperate forms predominate over tropical; and, lastly, to mention as nearly as it is possible the range of any group of animals in preference to that of any individual species: both objects, however, are desirable. In addition to the above desiderata, it will be necessary to note the seasons of Insects and times of their appearance, the soil in which they are found, and the vegetation upon which they live; since the distribution of animals in general is greatly dependent on food, which food will abound, or be found deficient, according to the richness or poverty of the soil, or according as the degrees of heat and moisture influence the same. It appears to me, that it is chiefly in swamps, and in low and marshy lands acted on by the rays of the sun, where there is a union of heat and moisture, that the major part of Insects seem particularly to flourish. In such localities we find genera more abundant, a great increase of species, the number of individuals prodigiously augmented, and the energies of life more rapidly developed. Animals appear more than usually productive, either in the alluvium of mighty rivers, or in the tropical jungle. It was on the banks of the Nile, amid its slime, acted on by the influence of the sun, that the doctrine of spontaneous generation originated, and I am told also entertained by the ancient Brahmans on the banks of the Ganges, as seen in Susruta. It is in like situations, where heat and moisture predominate, that nature still exhibits her surpassing and inexhaustible fecundity.

If we next turn our attention to the tropical jungle, we meet there with nearly an equally teeming exuberance and productiveness of species. The heavy tropical rains saturating the accumulated mass of heated leaves, and vegetable matter, considerable vapour is produced peculiarly adapted to increase insect life; and it is not a little singular, that as soon as the first showers fall in these regions, all nature becomes reanimate; and as the rains increase, so do the Insects in proportion more and more, till the rainy season fairly sets in, at which period the jungle and the forest literally teem with myriads of insect population, more numerous than the stars of heaven, and as countless as the sands of the sea-shore. In concluding this part of my subject, I need only repeat shortly, that heat and moisture combined, exercise a powerful control over the geographical distribution of insect life, and that this distribution is also influenced in a greater or less degree by vegetation, as well as by the soil of a country; but these are subjects which require further elucidation.

INFLUENCE OF VEGETATION.

The entomologist who wishes for accurate information respecting the geographical distribution of Insects over the wide extent of our globe, must take into his consideration not only the influence of temperature, but that of vegetation; nor should he omit to note the varieties of soil which materially influence it. The dependence of this distribution of animals, although greatly swayed by temperature, is no less so by the supply of food and nourishment they can obtain. Insects are designated according to the kind of food they consume, as carnivorous or phytyvorous; and in proportion as food is ample or deficient, so probably they abound in numbers, or decrease and vary in magnitude and form. To its abundance we may in some measure attribute size, to its deficiency the frequency of dwarfishness of stature, immaturity, and many of the numerous crippled specimens, as also some of the monstrosities found in our collections. The great Latreille has justly observed, that where the empire of Flora ends, there also terminates that of Zoology; and I have little doubt, that where vegetation is richest, there animal groups also will be found most abundant in genera, species, and individuals, not only those which are herbivorous, but those also which are carnivorous.

It is not my intention here to enter into any details respecting the Himalayan or Indian Flora. If the reader requires information on these points, I refer him at once to the accurate and invaluable pages of Dr. Wallich and Dr. Royle; and as I at present look merely to the vegetation, as influencing in a great measure the character of the entomology of the country, a concise outline of the leading features of the Botany of those regions is all that is here requisite. Throughout India, according to the above authorities, there appears to be an uniformity of vegetation, tropical species greatly predominating over those of the temperate zones; there occurs also a considerable admixture of genera belonging to temperate climes, and at a high elevation plants abound, which are indicative of Alpine regions. Several genera appear common to Europe, North America, and India; and in some instances identical species have been recognized as existing in Europe and in Asia, as well as in the New World. It still remains, however, with the botanist to determine the similarity of vegetation in Western India and Africa, a similarity which I anticipate will be eventually found to exist, if not at present actually known—a similarity I am led to suspect solely from observing a great resemblance in the character of the entomology of Western India and Eastern Africa.* In many instances cognate species of Insects appear both in Africa and Asia, which, by a careless observer, might be considered only as varieties; they are, however, on examination, sufficiently distinct, and I therefore think myself justified in esteeming them the representatives of their respective countries, as undoubtedly they fulfil the same offices and functions in both. In several cases we meet with identity of species in Asia and Africa; and there is an observation

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* Vide p. 159 of the "Illustrations," where the similarity of vegetation in parts of India and in Western Africa is referred to, as originally remarked by Mr. Brown, and which has been confirmed by subsequent discoveries.—J. F. R.

I have made, worthy of still further investigation, that most of the Insects which are identical in both countries, are either coprophagous or phytyphagous; in short, vegetable feeders, which circumstance would lead one to suppose a similarity of vegetation in the different regions.

It may here be expected, perhaps, that I should state the relative proportions of the carnivorous and phytyvorous Insects; and I cannot but regret that I have not as yet followed up my investigations sufficiently to enable me to draw a satisfactory conclusion. Messrs. Kirby and Spence, in their interesting work, speaking of our British Fauna, esteem these groups as nearly equal in number. I must confess my own observation induces me to believe, that the latter greatly exceed the former in our own country. With respect to the phytyvorous group in tropical climates, they certainly greatly out-number the carnivorous; and were it not so, the air in those regions would scarcely be habitable, considering the nauseating effluvia arising from excrementous matter, which the Copridæ in particular tend to neutralise, by consuming, decomposing, and burying in the earth, all that is obnoxious and liable to putrify. In proof of this assertion, I will only here add, that five of the greatest groups with which we are acquainted, namely, the Lamellicornes, the Sternoxes, and the Longicornes, the Curculionidæ and Chrysomelidæ, are almost entirely phytyvorous or xylobious; and it may also be naturally inferred from the superabundance of animal life of all classes within the tropics, particularly the Ruminantia, that there also vegetation will be found most luxuriant; yet, looking to Insects only, we find they are scarcely sufficient to keep in check its excessive exuberance In addition to multiplied forms of genera, we have an extraordinary increase of species and of individuals. It is in these same prolific regions also, that the mighty Goliathi and gigantic Prionidæ abound, where they perforate the trunks of the proudest monarchs of the forest, and hasten them onward to decay; and, by means apparently inefficient, check vegetation. It is time, however, to add a remark on the carnivorous Insects, which, although inferior in numbers to the phytyvorous, are still an important group; and in northern regions, by removing the decomposing matter from the decaying and putrifying carcass, fulfil the functions assigned to them by Providence. In tropical regions they are certainly not always so abundant, as a dead body, from the natural dryness of the air, and intense heat of the sun, is frequently dried up before putridity has made much progress; at least, such is the case in the Pampas. I cannot help thinking, however, although our cabinets contain but few species from equinoctial and tropical latitudes, that eventually they will be found more numerous, and that in these regions we shall still find them more proportioned to the excess of animal life than appears to be the case at present. Religious prejudice, and the filthy and disgusting habits of these Insects, may be the causes why they have been neglected. In India, if the Necrophaga are not so numerous as elsewhere, yet the numbers of some particular species being excessive beyond measure, are sufficient, perhaps, to compensate for want of variety.

RANGE.

In the consideration of the geographical distribution of Insects, especial notice should be taken of the range over which genera and families extend. From want of attention to this subject, entomologists have not sufficient data to form any just views respecting it. Every naturalist who has studied animals, must be aware that certain tribes, genera, and species, are peculiar to particular regions of the globe. On the contrary, in various countries of the earth the Botanist meets with genera of plants which are common to Europe, and the other quarters of the globe, to the Old World as well as to the New. In some instances, identity of species has been recognized in countries remotely situated, between which seas and oceans intervene. It becomes, then, a question of considerable importance to determine if any species of plants have an unlimited or universal range, as probably all those insect races which feed on vegetables are regulated in their distribution by the same laws which govern the distribution of the plants themselves. It must be evident even to the most careless observer, that where the climate is materially changed in temperature, that there vegetation will be proportionately altered, and I imagine that eventually the entomological character of a country will be found much more dependent upon vegetation than has hitherto been allowed. It is true, indeed, that although two countries may agree in temperature and botanical character, the Insects may be totally different in form and appearance; but, in looking to their functions, if we find them the same, or nearly the same, we at once acknowledge the resemblance, and imagine they take the place of other known and existing groups elsewhere; a resemblance of character, which Messrs. Kirby and Spence have very properly denominated representation, which representation will even be more perceptible as the soil and general characters of the countries accord.

INFLUENCE OF SOIL.

Having already seen that both temperature and vegetation exercise a powerful control over the geographical distribution of insect races, there still remains a third subject of inquiry, namely, the influence of soil over the same groups. If we find that in particular rich soils various genera of Insects abound, and that in others of an inferior quality scarcely a species can be met with, may we not naturally infer that there must be some peculiarity in it, and that the animal groups are influenced by their attachment to the same? The Botanist readily admits that vegetation is materially influenced by it, but as yet the Zoologist has made little inquiry respecting this subject, replete as it ever must be with high interest, and well worth most serious attention. Without entering deeply into the geology of India, I may state, on the authority of Colonel Sykes, that the character of the geology of great part of the Peninsula, like that of its vegetation, presents considerable uniformity: unacquainted with its leading features, I can derive my observations respecting it solely from the examination of the genera before me. I will, therefore, merely give concisely what groups attach themselves to particular soils in different countries, and hope that the attempt, imperfect as it is, may induce other naturalists to undertake an inquiry which must lead to very important results. As the mountain, the valley, and the Plain, have their own peculiar temperature, vegetation, and soil, they have also particular groups of animals attached to them; and if we look more closely, we shall find that particular families and genera are always to be met with in certain strata and soils, evincing, as it were, a partiality and adaptation, by frequenting and thriving in them.

It may here be worth while to specify some of the genera of Insects attendant on the difference of soil. It is in the sandy districts of our own country that the few species of Cicindela, peculiar to our island, occur. Cicindela maritima, however, prefers the vicinity of the sea-shore, while several Oriental species, remarkable for their beauty and colouring, delight more in the alluvial soil of rivers Frequenting the sandy heath are found the splendid Chlorion, the fetid Sphex, and restless Ammophilus, associated with numerous species of Andrena and Nomada. In the sand, washed from the mountain height, at the sources of our European rivers, some species of Nebria and Psammodius are exceedingly abundant. If we visit the parched and burning sands of Africa, we there meet with the rapacious Anthia, the desert-loving Graphiptera, the burrowing Scarites, and countless species of Heteromera and Tetramera. In the same soil also, on the banks of rivers, the genera Epaphius and Trechus, Clivina and Dyschirius, are not unfrequent. On the sand of the sea-shore, Broschus, Bradytus, Pediuus, and Ægialia, occur in extraordinary numbers; and where it is habitually covered with salt water at the departure of the tide, we capture Cillenum, Pogonus, Hesperophilus, and Heterocerus, the singularly-formed Bledius, and wonderfully-abundant Ophonus pubescens, all of which I have reason to believe can live submerged beneath the sea a considerable period. Of all other soils, *clay*,[*] being naturally cold, attracts fewer Insects, excepting the widely-disseminated Harpali. In gravel, occur the genera Opatrum, Halictus, Cerceris, with numerous colonies of Ants. To a chalky soil are attached the Ophoni, Licini, Chœtophora, and various species of Polyommata, Osmia spinulosa, and Andrena hæmorrhoidalis. When collecting in the mud of the fresh-water marsh, we capture Blethisa, Chlænius, Omaseus, and Agonum, and several Carabidæ. In the slime of brackish waters, several Notaphi are exceedingly abundant, though rare elsewhere; and in company with them we find the subaquatics Elophorus, Parnus, and springing Salda. It has also been observed, that Pimelia is only to be met with where the plants of the genus Salsola abound. Catascopus and Elaphrus frequent the alluvium of rivers. In the mud of lakes and pools various genera of Eupodina, Nothiophilus, Bembidiadæ, and Trechidæ occur; and in vegetable mould, where the grass is luxuriant, numerous Diptera, and Larvæ of Lepidoptera, abound. Even in this short and imperfect account of different genera attached to varieties of soil, sufficient has already been stated to prove that it exerts an important control over the range and distribution of Insect races: however, to give the naturalist a better insight into Indian groups, I shall here add an analysis of the leading families and genera which have fallen under my observation, and then conclude with an abstract describing the leading characters of Himalayan and Indian Entomology.

From what has already been written, it will appear that Insects, in their geographical distribution, are influenced by various causes; by temperature, by excess or deficiency of moisture, by the influence of vegetation, and by soil. There is yet, however, another, which materially affects, in some instances, particular groups, namely, the peculiarity of the organization of the Insects themselves. Should any genera of Insects occur which are deficient in the organs of locomotion, they would naturally be restricted to certain localities. How many genera of the Coleoptera and other orders are apterous, and are only found in particular situations; and they have necessarily particular functions to perform in their restricted limits, and also particular organs adapted to the work assigned them by the Creator. It is to the study then of the differences of organization adapted to differences of situation, and other external circumstances wherever we find Insects, that the entomologist should direct his attention. Contemplating all these instances of adaptation, we reverence the wisdom of a creative and the beneficence of a superintending Providence, that prevents diminution and increase, both extremes of which would prove injurious; for without these "armies of the living God," to keep in check the fecundity of nature, plague and pestilence would walk abroad, and depopulate not a single country, or one quarter of the globe, but the whole earth itself.*

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[*] Mr. Shuckhard informs me, that Andrena labialis seems peculiarly attached to the London clay.

ANALYSIS

OF THE ENTOMOLOGY OF THE HIMALAYAS AND OF INDIA.

CICINDELIDÆ.

The following genera belonging to this family are not uncommon in India, *viz.* Therates, Tricondyla, and Colliuris: the two former are characteristic of a southern range, while the latter is abundant throughout the eastern continent. Of Indian Cicindelidæ, more than sixty species have fallen under my notice: the most splendid of the race abound in Nepal. Among various species, however, peculiar to the Himalayas, only one approaches the form of our European Germanica.

DRYPTIDÆ.

As I am only acquainted with a single species of Indian Casnonia, I pass on to Drypta, a Nepalese individual of this family belonging to the genus Desera, Leach, which is described in General Hardwicke's collection. Five others are also recorded as inhabiting India.

LEBIADÆ.

Cymindis has not yet been discovered in India; eventually it may occur in the Himalayas: it is difficult to imagine what genus takes its place. Lebia is of rare occurrence in the East; a non-descript, named unicolor, in my collection, is from the Himalayas. Aploa is found at Poona. Orthogonius is common to Africa and Asia: the gigantic species, however, predominate in the latter country.

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* In concluding my observations on the geographical distribution of Insects, I think it may be stated, that naturalists on this subject have almost exclusively directed their attention to temperature. Where temperature fails, we may turn to vegetation; and if the latter is not sufficient, then to the soil and strata of a country, and even to the organization of the Insects themselves, as well as other causes. No one by itself is sufficient to unravel the difficulties which arise; by uniting all, however, we may in a great measure account for the various discrepancies that occur.

BRACHINIDÆ.

The French writers appear unacquainted with the true type of Helluo, exclusively belonging to New Holland: the genus denominated Omphra by Dr. Leach, applies solely to the Indian Helluones. Ozæna and Pseudo-zæna inhabit Calcutta and Cayenne; while Trigonodactyla appears in Africa and Asia. The Graphipteræ of the sandy deserts have no representative in the East. This genus appears to unite Brachinus and Anthia: the latter is found throughout the continent of India. Some of the specimens from Nepal, however, are very diminutive. Aptinus is partly confined to Northern Europe and America; while true Brachinus enjoys the unlimited range of the world. Catascopus is found in Nepal, and resembles in its habits Elaphrus of Europe, and probably occupies its place. Dyscolus, Promecoptera, and Thyreopterus, prefer the southern tropical regions, and are not found to range as far north as the Himalayas.

SCRAITIDÆ.

Siagona atrata is met with in Nepal and various parts of India: a specimen lately received from Egypt, if not the self-same, is so exceedingly alike in size and sculpture, that it is very difficult to distinguish. The Scaritidæ abound in both hemispheres. Scapterus of India is represented by Oxystomus in the Brazils, and in Africa by Acanthoscelis. Morio and Clivina will, perhaps, be found in both the Old and New World; the latter, indeed, is common to all temperatures; the former may eventually occur in Europe, perhaps in Sicily.

HARPALIDÆ.

Harpali are found dispersed nearly in all the countries of the globe: they abound more in the arctic than antarctic regions. The following genera are recorded as belonging to India, *viz.* Harpalus, Platymetopus, Selenophorus, Cyclosomus, and many others. Some species of Ophonus from Bengal and Poona, closely resemble British species.

POGONIDÆ.

Some of the genera of this family are not confined to the temperate zones; the major part of them prefer the polar regions. Pogonus and Cardiaderus are met with in Asia and Africa; while Patrobus is apparently peculiar to Northern Europe and America.

CALATHIDÆ.

Dolichus has not yet been discovered in India: it is probable, however, that it will occur there. Pristonychus inhabits Nepal and Europe; while Calathus prefers a northern more than a southern climate.

FERONIADÆ.

Instead of finding Pœcilus in India, we meet with Trigonotoma, Catadromus, Lesticus, and Distrigus: most of them peculiar to that continent. Argutor antiqua occurs in the East; Omaseus and Platysma in Nepal; and Steropus in the vicinity of Poona. It is by mistake that Percus has been introduced among oriental genera. Cephalotes is found in Nepal and Australia: Stomis, Zabrus, and Pelorus prefer the temperature of Southern Europe. They may, however, be expected to appear in the Himalayas. Amara is captured in Japan; Antarctia and Masoreus are equally natives of Europe, Africa and Asia. Several nondescript species from the East, of the latter genus, are to be found in our English cabinets.

SPHODRIDÆ.

The genus Sphodrus occurs in Nepal, and the anomalous form of Mormolyce in Java and Singapore; which last has been ranged with this family, but appears to be sadly out of place, as it is most likely a subcortical feeder.

ANCHOMENIDÆ.

I am not aware that Platynus, Agonum, or Olistophus, have yet been discovered in India: the two former will no doubt be found in the Himalayas, when the Insects of that country are better known.

CALLISTIDÆ.

Epomis and Chlænius abound in the tropics: the maculated set appear common to Asia and Africa, each country possessing species almost exact representatives of each other. Chlænius nepalensis approaches in form to Licinus; and although Oodes is widely dispersed over India, no Nepalese examples have yet come under my notice. Callistus occurs in the Mysore.

DICŒLIDÆ.

Rembus is found on the Malabar and Coromandal coasts, at Calcutta, and in Nepal: its allied genus, Licinus, may be expected to occur, as some Asiatic species have already been described. Panagæus has its metropolis in India.

PROCERIDÆ.

Among the Insects collected by Dr. Wallich, there were four or five species of true Carabus, only one of which I was enabled to describe. Several may occur in the colder mountain temperature, and it is probable they will resemble Siberian forms. Wherever the oak grows, there Calosoma will be found. Seven eastern species are known to me. C. indicum inhabits Nepal. If caterpillars are necessary to keep in check the luxuriance of tropical vegetation, surely the Calosomata are equally necessary to keep within bounds these Insects, which sometimes destroy, in northern climes, nearly the foliage of the year.

NEBRIADÆ.

This family may be considered as belonging to a Northern and Alpine range. Should it occur in Nepal, it will be found at a considerable elevation, possibly amid the Himalayan snows. As to Elaphrus, I have already stated an opinion that Catascopus represents it in India.

BEMBIDIIDÆ AND TRECHIDÆ.

Of the former family, several genera will no doubt eventually be found in Nepal: a single species of Tachys is the only example I am able to record at present. Of the latter, Stenolophus, Acupalpus and Tetragonoderus have occurred: the last of which may take the place of Bembidium.

DYTICIDÆ.

Aquatic Coleoptera are apparently not much influenced by climate: the temperature of water not varying like that of the earth or air, is the reason we meet with the self-same species in the interior of India and the south of France. Dyticus appears confined to Northern Europe or America, while Cybister is dispersed throughout the world. Eunectes and Hydaitcus belong to Nepal and India, and to the latter country we may add also the following genera, *viz.* Colymbetes, Laccophilus, Noterus, Hyphydrus and Hydroporus.

GYRINIDÆ.

Many gigantic species of Gyrinidæ abound in India. Dineutus nepalensis, politus, and spinosus, have been found within the Himalayan districts.

HYDROPHILIDÆ.

Several genera of this family are as widely distributed as the Dyticidæ; and most of those found in India inhabit Nepal.

NECROPHAGA.

Differing with most entomologists, I am inclined to believe that the carrion feeders abound more in warm countries than is generally believed.

The religious prejudices of the Indians not allowing them to touch a dead body, may account for the few species which have hitherto reached Europe from the East. Necrophorus, Necrodes, Silpha, and Oiceoptoma, are met with in India and Nepal. It is probable that Necrophorus is more peculiarly adapted to Northern climates, while the remaining genera affect those of tropical regions.

EROTYLIDÆ.

Passing Nitidulidæ, which have been captured in India, we arrive at Engidæ and Erotylidæ. In the former family, we find Triplax, Ips, and Dacne; in the latter, Erotylus; and next to this group, Languiria and Eumorphus should be placed; genera abounding in species in Nepal and India.

DERMESTIDÆ.

In General Hardwicke 's Collection, there is a Nepalese specimen of Dermestes, similar in every respect to D. lardarius of Europe: a second species is closely allied to D. vulpinus of Africa. It is scarcely possible that either of them can have been imported into the Himalayas by commerce. This genus, and its congeners, is apparently a predominant group throughout the world.

BYRRHIDÆ.

The foreign Helocerata require attentive examination. Among the drawings of the Nepal Collection, made purposely for General Hardwicke, two species of Anthrenus are figured: they appear novel in form.

HISTERIDÆ.

This family abounds in India. I am acquainted with more than fifty species from the East: some of the Nepalese specimens are in too mutilated a state to describe.

LUCANIDÆ.

I formerly described six species from Nepal: two more from the Himalayas are undescribed in Dr. Royle's Collection. In no country is there a greater admixture of temperate and tropical forms than in India; some of the Lucanidæ resemble our British species very closely, while others are the same as those in Java and Singapore. Forty species have been submitted to my inspection. Passalidæ are not equally abundant in the Old as in the New World.

LAMELLICORNES.

The celebrated Ateuchus Ægyptiorum, or Sacred Beetle, has almost an exact representative in India. Gymnopleurus capicola, Hope, and azureus, Jab. both of them African species, are replaced in the East by G. sinuatus, Jab. and splendens, Hope. Sisyphus is met with in both hemispheres. Epirinus is an African, as well as an oriental form. Several Indian Copridæ resemble those of Egypt. Copris Midas of India and Nepal, exactly corresponds with C. Isidis of Africa. C. Sabæus and Pithecius appear common to both continents, and are equally abundant in Ceylon; and several smaller species of Copris, from the eastern part of Africa, if not the same, approach so closely to those of Western Asia, as to induce a belief that they are the same Insects, only modified by climate. Onitis and Oniticellus have also several representatives in both regions, if not in some instances the self-same species. Onthophagus abounds more in India than any other country; some of them unrivalled in size, splendour, and variety of form. More than 120 oriental species may be seen in European cabinets; five only now are described from Nepal; double that number, however, are in too mutilated a state to be characterized. Pactolus of Nepal and India, is represented in Senegal by Harpax, Jab. Aphodius, compared with Onthophagus, as an Indian group, is quite insignificant; scarcely twenty species are recorded, including those of Manilla and the Eastern Isles: a non-descript from Nepal will appear in the Appendix. As there is only a single specimen of Trox in General Hardwicke's collection, I pass on to

GEOTRUPIDÆ.

Geotrupes has been denied by Latreille to exist in India; the Baron de Jean also makes no mention of any Eastern species from that country in his last catalogue. Two species are in my recollection; one from Delhi, and a second from Japan; a third also, unique, is among Dr. Royle's Insects from the Himalayas. It is probable that this genus, when found in India, appears on mountains at a considerable elevation: the species also may be the common food of the Shrikes of that country, as they are in Europe, should those birds be found there. Orphnus, Athyreus, and Hybosorus, occur in India. Bolboceas appears in some measure to supply the place of Geotrupes, which last is not so important a group in the East, as in a northern region.

SCARABÆUS.

Under this term, the gigantic and most remarkable Insects of the Old World are ranged. Four species, allied to S. Atlas, Jab. are indigenous to Nepal, a convincing proof that equatorial forms extend beyond the tropics, and that they are found in much colder temperature than is generally believed. There are several genera of Scarabæidæ, besides Oryctes, found on the Himalayas, as yet uncharacterized; some of them approaching African types.

MELOLONTHIDÆ.

Some of the Melolonthæ of Nepal are closely allied to our British M. vulgaris; others again, with the margins of the thorax serrated, evince their affinity to tropical species. Geniates, Apogonia, &c. are common to the Himalayas, the whole continent of India, and the Southern Isles.

MIMELÆ AND EUCHLORA.

These genera appear peculiar to the East: in a monograph, read before the Entomological Society, there are thirteen Mimelæ described; several from Nepal. Euchlora appears wherever Mimela ranges, and is more abundant in species.

POPILLIA.

This genus appears nearly equally abundant in Asia and Africa, and is common to the Old and New World. Fourteen species have been collected in Nepal. The following genera of Melolonthidæ, also, *viz.* Anomala, Hoplia, Apogonia, and Adoretus, occur in the same territories.

TRICHIIDÆ.

Acanthurus, Trichius, and Dicronocephalus, inhabit the Himalayas. The first of these forms approaches our European type, the latter is the representative in India of what Goliathus is in Africa, and Incas in Southern America. Goliatidæ is a conspicuous family, and may justly be ranked among the most extraordinary forms of the Insect world.

CETONIADÆ.

Although I described seventeen species from Nepal, Dr. Royle's collection appears to contain at least six more, entirely new. Campsiura xanthorhina, Hope, is represented in Africa by Cetonia scutellata, Jab. C. cornuta, Jab. is found in Africa, as well as Asia. I am acquainted with more than 111 species from India, and from this surprising number still likely to be greatly increased, it is evident that the metropolis of Cetoniadæ is situated in the tropical regions.

BUPRESTIDÆ.

Of this superb and extensive family, comprising at present more than one thousand species, existing in the cabinets of Europe, the most magnificent inhabit India; the splendid Sternocera and giant Catoxantha range the Equator and the Tropics. Ninety species belong to the continent of India, many to Nepal, the isles of Java and Sumatra: among them are forms of temperate as well as of northern climes.

ELATERIDÆ.

This family persents us with types of form belonging both to the tropical and temperate regions: the former, however, are few in number, when compared with the latter. Several of the Nepalese Elateridæ resemble our British species, some so closely as to induce one to imagine that difference of climate is the cause of variety of the species. Elater murinus, Jab. of England, is well represented in Nepal by Elater cœnosus, Hope; and various species, which in Europe frequent the oak, alder, and willow, have Nepalese species nearly resembling them, and we have stated that there is a correspondence of vegetation between Europe and the Himalayas.

LAMPYRIDÆ.

Passing the Cebrionidæ, few examples of which occur in India, we arrive at the Lampyridæ; and justly may the East boast of its numerous and fine species, unsurpassed probably by those of South America. The warm damp of the jungle is peculiarly adapted to the habits of this family. Lycus and Omalysus, as well as Lampyris, abound in the Himalayan range.

MALACODERMATA.

By some writers, the families composing this group are considered rare within the Tropics, and they certainly are more abundant in Nepal than Central India; and yet they are not of rare occurrence. Anisotelus, Hope, appears to be peculiar to the East. Several species of Malachius and Melyris enjoy an Asiatic and African clime.

CLERIDÆ.

By the family Cleridæ abounding in the East, we arrive at the Ptinidæ; they, the latter probably, exist in Nepal; none, however, I believe, have yet been discovered in India, the nearest locality where they are found being the Mauritius. The Bostrichidæ are, however, abundant, and it is not unlikely that the Paussidæ commence where the Ptinidæ terminate.

CURCULIONIDÆ.

Without entering at large into the geographical range of the numerous genera of this family, I briefly state, that Nepal contains many tropical forms, as well as others, which are peculiar to temperate climes, some of them extending from the Himalayas, even to New Holland, particularly Sipalus.

PRIONIDÆ.

By the Cucujidæ (common to India and Nepal) we arrive at the Longicornes. Prionus loves the torrid and tropical zones; some of the Himalayan species indicate an alliance to European types.

LAMIADÆ.

The largest, as well as the most beautiful species of this family, are found in Nepal. Lamia Roylii, Hope, is unrivalled in size; and L. Wallichii surpasses all others in beauty and colouring; it is found in Nepal, Japan, at Singapore, and the Isle of Java. Cerambyx, Callidium, Clytus, and Saperda, are predominant groups, and are found in all countries and climates. Many Nepalese species exactly represent our European types.

SAGRIDÆ.

Omitting Lepturidæ, confined almost entirely to Northern Europe and America, we arrive at Sagridæ. Donacia occurs in Java, and we may expect to meet with it in Nepal, and other parts of India; if not, it is probable that Sagra takes the place which Donacia does in northern regions. Several species of this genus are found on the Nympheacæ. I am doubtful if Sagra attaches itself to peculiar water-plants, or frequents the same as the former genus. Megalopus is found in Nepal, in Africa, as well as South America. Crioceris also appears to be a predominant group, while Adorium is confined more to Asia than Africa.

GALLERUCIDÆ.

Galleruca and Auchenia abound in Nepal, Halticæ are found throughout the world, and are intended probably to keep in check particular vegetation. In Europe, the genera Brassica and Sinapis almost annually suffer from their depredations; they appear to abound more in light and sandy soils; and where lime is used instead of animal manure, the crops are less attacked.

CHRYSOMELIDÆ.

Many of the Nepalese species resemble those of Siberia; others approximate closely to our European forms, so much so, that in many instances they appear like one and the self-same Insect; and if not the same, they are certainly similar representatives of their respective countries, and probably fulfil the same offices and functions. Podontia and Phyllocharis seem peculiar to Asia and New Holland.

EUMOLPIDÆ.

The Eumolpidæ of India are not surpassed in beauty or splendour by those of South America: they seldom, however, equal the latter in size. Clythra and Cryptocephalus occur in the East, both of them abounding more in temperate than tropical countries; in Dr. Royle's collection there are found several undescribed species from the Himalayas.

CASSIDIDÆ.

About fifty species of Indian Cassida have come under my notice; some of the Nepalese species resemble our English specimens, and may be parasitic on the thistle, as they are with us.

COCCINELLIDÆ.

Although I described twenty new species from General Hardwicke's collection of Nepal Insects, I find five others undescribed in Dr. Royle's collection from the Himalayas. Coccinella 7-puncata, Fab., appears common to Europe and Asia; at least the specimens agree so exactly in every respect, that after a very accurate examination, no important difference can be found; and believing them to be the same, I still cannot imagine that they have been imported into India by commerce. Endomychus may eventually be expected to occur in Nepal.

HISPIDÆ.

Hispa erinacea is abundant in Nepal; and two undescribed species are in Dr. Royle's collection from the same country.

TENEBRIONIDÆ.

The transition from Hispidæ to the present family by means of Sarrotrium is rendered easy. Ilegeter and Tagenia, common to India, appear to follow in successive order. Both Upis and Tenebris are found in the Himalayas, and are abundant in the Tropics.

PIMELIARIÆ.

Pimelia has not yet been described as existing in India; last year I received two species from the vicinity of Poona. Sepidium, Blaps, Eurynotus, and Opatrum, occur in the East; the first prefers the Southern Tropic; the two next appear at Bombay, Calcutta, and Nepal; and the last is widely dispersed throughout the East. Passing Diaperidæ and

Cossyphus, both of them common to Asia and Africa, we next meet with Cistela and Lagria: the latter apparently a predominant group. Pyrochroa, also, has been discovered in Java.

HELOPIDÆ.

This family is the grand receptacle for the various forms of Heteromera. Among the Indian genera we find Amarygmus, Cnodulon, and Platycrepis, with several true Helopidæ, rivalling in splendour and magnitude those of the South American Continent.

MORDELLIDÆ.

Most of these Insects are parasites of the Hymenoptera, and abound in tropical climates. Their office is probably to keep in check, and prevent the too rapid increase of Vespidæ and Bombidæ: they are common to the Old and New World.

CANTHARIDÆ.

The geographical distribution of this family is particularly interesting, as it contains those Insects which are used in Medicine, and denominated Blister Flies. Lytta gigas, Fab., is found abundantly in India, and also in Senegal; and there is little doubt that several species of Mylabris will be found common to both continents. These vesicatory Insects of the Old World are replaced in the New by the genus Tetraonyx.

STAPHILINIDÆ.

By the families Notoxidæ and Scydmænidæ, we arrive at the Pselaphidæ, and afterwards at the Brachelytra, which terminate the Coleoptera. Anthilephila and Notoxus occur in Nepal, and Scydmænus in Java; while various other genera of Staphilinidæ are widely dispersed throughout the East.

ON THE REMAINING ORDERS.

Having entered fully into the consideration of Eastern Coleoptera, it is not my intention at present to go into lengthened details of the remaining Orders. It is sufficient to state, that in all of them there will be found similar and corresponding characters as in the Coleoptera. With regard to identity of species, I cannot help remarking, that of Lepidoptera, there appear to be a much greater number of species, widely disseminated throughout the world, than of any other Order. In Asia and Europe we meet with Papilio Machaon, Gonepteryx Rhamni; with some species of Colias and Pontia, with Vanessa Atalanta, and Cynthia Cardui; and to these might be added, several identical Sphingidæ, particularly Acherontia, Atropos, Deilephila, Celerio, and Sphynx. Among the Noctuidæ, Geometridæ, Tortricidæ, and Tineidæ, many species will also be found inhabitants of both continents. In the Orthoptera, some Gryllidæ are common to countries remotely situated, which may partly be accounted for by the migratory habits of these Insects; and the same remarks may be applied to the Sphingidæ. Among the Blattidæ, several tropical species range widely; some of them have become naturalized even in a northern climate; and it is no uncommon occurrence to find Indian, Brazilian, and New Holland, species in a high state of perfection alive in the houses of London; and among the Eastern Neuroptera, there occur various Libellulinæ and Hemerobeidæ, closely resembling our English species.

Among the Hymenoptera, may be noticed the universal ranger, Evania appendigaster, ever attendant on Blatta; some Icheumonidæ, Crabronidæ, Apidæ, and Vespidæ, all of them presenting identical species with those of our own country. In referring to the Diptera, I need only mention the wide range of the Orange Fly, the same in England, India, and America; the Gnats and Mosquitoes, common to the four quarters of the globe, alike the pest of the Indian and Laplander; and, lastly, various species of Musca, as widely dispersed as the half-domesticated sparrow of Great Britain. Passing by the Aptera, and the various parasites of birds, quadrupeds, and of man himself, we shall find also among the Hemiptera, several identical species of Pentatoma, Reduvius, Tetyra, besides Cimez lectularius, the scourge of all countries and climates. It does appear, then, from the above Analysis, that Asia and Europe have many Insects in common, and probably other parts of the world will eventually be found to present not only similar genera and representatives, but also the same identical species, subject to the modifications of climate, and other external circumstances.

CHARACTER OF HIMALAYAN ENTOMOLOGY.

The character of Himalayan Entomology is twofold, Asiatic and European; and the intermingling of forms of temperate and tropical climes is one of its most distinguishing peculiarities. In its valleys (probably influenced by the heat and moisture of the jungle) southern forms predominate over northern; and it is not unlikely, that to the uninterrupted belts of jungle stretching along the mountain ranges, we may partly trace several tropical phytyvorous genera far beyond their apparent natural limits. Some carnivorous Insects are also found ranging far to the north in the Himalayas; an example of which is Anthia 6-guttata, a well-known native of the Tropics : the specimens, however, are mere dwarfs, compared with those of Peninsular India, a fact which may be regarded as a proof, that Anthia has here reached its extreme limits, and consequently will soon disappear (as is the case) and be represented by another type, fulfilling the same functions, only under a difference of form. The following genera of Himalayan Insects, selected from many others, will evince their tropical relationship. Among the Cicindelidæ, Colliuris appears; among the Carabidæ, we find Desera, Omphra, and Cyclosomus; among the Lamellicornes, Euchlora, Mimela, and Dicronocephalus; and to these may be added, Anisotelus belonging to Telephoridæ, and Podontia and Phyllocharis to the Chrysomelidæ : all of them attached to warm countries, and some, indeed, are seldom found but within the Torrid Zone. It is needless to state many genera from the Himalayas evincing an affinity to European types;* some few, however, are worth noticing, such as Broschus and true Carabus, Geotrupes and Pimelia : the two last have been declared by high authority never to be found in India. Regarding identity of Insects occurring in the Himalayas, as well as in Europe, there are several species of the following genera of Coleoptera, namely, Elater, Melolontha, Chrysomela, Cassida, and Coccinella, which I cannot help thinking are the same as those of England; particularly as the vegetation of the two countries greatly coincide, for in very many cases, genera, and in some instances the self-same species of plants have been recognized. Among the carnivorous Insects, I believe that Dermestes lardarius, and vulpinus, Corynetes violaceus, and rufipes, and some of the Staphilinidæ, are essentially the same in Europe and the Himalayas. Of Lepidoptera, I figure Papilio Machaon, because it is evidently the same as what we meet with in England; the same remark will apply to Vanessa Atalanta, and Cynthia Cardui. The French entomologists are inclined to regard the Insects of widely separated countries as distinct species; I wish to esteem them as varieties, and I cannot help thinking, that as identity of Plants has been satisfactorily proved by Dr. Royle, so also we may believe in the identity of Insects in regions widely removed from each other. At any rate, should these varieties eventually prove distinct (which may be ascertained, I think, in the Lepidoptera order, when we become better acquainted with the oval, larval, and chrysalidous stages), yet the differences will ever be so slight, that we cannot separate or distinguish them in the imago state with any degree of certainty. But whether they be accounted species, or only varieties, we see the grand object of their creation, in their fitness for performing certain functions which are assigned them; one of these is, to keep in check the luxuriance of vegetation and to restrain it within due limits; another may be, that these puny agents may fecundate the flowers, by carrying the fertilizing pollen from tree to tree, and thus be the means, in one case, of promoting vegetation, as in another they are the agents of its destruction.

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* I may here add, that various Himalayan genera closely approximate Siberian forms, and that some of the species described by Dr. Gebler from the Altaic chain of mountains, particularly some Chrysomelidæ, I believe to be indigenous in both regions.

ENTOMOLOGICAL CHARACTER OF INDIA.

From the foregoing Analysis, I have no hesitation in asserting that the pervading character of Indian Entomology is uniformity. It is true that we meet with numerous genera, both of tropical and temperate climes, associated together; the former more abundant, the latter less frequent (as we might naturally expect) than in the Himayalas. There is, however, a greater intermingling of forms than at first sight would be readily imagined; but when we take into our consideration, that many of the species resembling those of Europe may have been captured on the mountain ranges, at a considerable elevation, we may partly account for it. This attempted explanation, however, is not always available or satisfactory; for in the heated valleys of the East, we find many European types and species, in numbers sufficient to excite our astonishment. It will appear, then, that many species taken in temperate and northern climes, are not confined to them, and that the range they enjoy is very considerable, extending not only over the Old World, but also to the New. As we advance from the Poles to the Equator, vegetation is more luxuriant, in proportion as heat increases, and the quantity of work assigned to Insect races is proportionately increased. Is it not natural to imagine that the functions performed by them in a colder climate, would in a warmer one require increased exertion and capabilities? It does not follow, because we find new types of form in tropical countries, and new genera of superior bulk and power, and more abundant in individuals, that therefore they necessarily replace the old ones, and are to perform the duties peculiar to both regions; both may live and thrive together, and abound in the same countries, and will eventually be found to do so. When the genera of temperate climes appear within the Tropics, I see no reason why they may not have the same functions assigned them there, as in colder latitudes; but when we find new types of form, and a more powerful organization, with the size of the Insects greatly increased (as is the case in tropical regions), does it not almost naturally follow that they are intended solely for those regions, and for the increase of work they are there destined to perform? To return, however, to the subject of uniformity of entomological character throughout the Peninsula and the East, I think it probable that it is in a great measure to be accounted for by the general uniformity of its temperature, vegetation, and soil; there may, indeed, be other causes, which particularly influence it, but these may be esteemed the most essential. When we look to the range which genera here enjoy, it is very considerable: in part of the Himalayas, at the extreme southern points of India, in the West, and even in its Eastern Isles, there is one pervading character, evincing every where the prevalence of tropical genera. To speak more specifically, in Nepal and the southernmost extremity of the Mysore, and in Ceylon, at Bombay, and at Madras, at Calcutta and Singapore, in Japan and Java, with the rest of the Polynesian Isles, the majority of the same types abound; and what is of more consequence, a great majority of the same species also occur in most of the above-mentioned regions. Having noticed the intermingling of genera belonging to Europe and Asia, we may probably find a slight accordance elsewhere. Now, if we turn our eyes to Africa, we shall there find a considerable similarity in the entomology of this quarter of the globe with that of Asia; and this resemblance between the two countries will be readily seen by the short annexed list of some of the more particular genera, which are common to both of them. Among the Carabidæ occur Anthia, Orthogonius, Trigonodactyla, and Siagona. Among the Lamellicornes, Epirinus and Popillia, the conical Buprestidæ and the extraordinary Paussidæ, which last are chiefly found only in these regions; and to these may be added, as well as many more, the genera Melyris, Megalopus, Sagra, and Adorium; Dorylus, among the Hymenoptera, and Diopsis among the Diptera. Passing from genera to species, we shall find that precisely the same occur in both continents; among the most conspicuous, I shall mention but a few, namely, Copris - Midas, Sabæus, and Pithecius, Cetonia cornuta, and Lytta gigas. Even supposing that no identical species occurred, which were common to Asia and Africa, yet we could not help observing the very remarkable similarity in the representatives of each; one example of which is, Ateuchus sanctus, which very closely resembles the celebrated Sacred Beetle of the Egyptians, the object of their worship, by some regarded as an emblem of fertility, but I think more probably that of eternity. Before concluding my remarks on the similarity of Insects found in Asia and Africa, I cannot help expressing a wish that some individual may be induced to develope the character of the entomology of these gigantic regions more thoroughly than has yet been attempted; or there is an ample field for research and speculation. We shall feel much indebted to him, if he will explain how the Copridæ were transported from one country to another, and how they reached the island of Ceylon; how also Cetonia cornuta, which is taken on the banks of the Gambia, became an inhabitant of India. Lytta gigas may have travelled by land, and perhaps the Copridæ following the track and droppings of the camel, may have pursued the same route. Let him describe the sands of the desert and those in the vicinity of the Indus, give us a comparative Fauna of the Ganges and the Nile, record the varieties of temperature, the character of vegetation, and the genera peculiar to the different soils. Let him do this, following the steps of the celebrated Forskal, and he indeed will advance the objects of science, deserve the thanks of the present generation, and command the respect of posterity.*

Descriptions of Insects, by J. O. WESTWOOD, ESQ., F.L.S.

ORDER DERMAPTERA LEACH.

FAMILY FORFICULIDÆ.

FORFICULA MACROPYGA, Westw.

Piceo-nigra, punctata, abdomine æneo submicante, marginibus thoracis, tegminibusque rufescentibus, forcipe (♂) longissimo valde curvato, et gracili; (♀) fere recto tenuissimo.

Long. Corp. (forcipe excluso) ♂ lin. 6 ♀ lin. 5.

Ad genus Forficulam (stricte sic dictum Servilleo) appertinet, statura fere Forficulæ auriculariæ et paullo robustior, caput nigrum punctatum, impressionibus duabus anticis inter oculos. Antennæ ♀ (♂ mutilatæ) 13-articulatæ graciles rufescentes, articulis bassalibus obscurioribus.—*Prothorax* planus antice vix 'emarginatus, lateribus antice rectis, postice rotundatis, niger punctatus, margine tenui rufescenti; foveolis duabus rotundatis, antice impressus.—*Tegmina* piceo-refescentia, punctata, portio alarum detecta concolor. *Abdomen*

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* By pursuing the course recommended by Mr. Hope, a naturalist would be enabled, not only to display the connection between soil, temperature, and vegetation, as well as the animal forms which the latter supports, but also prove the advantages of studying the natural sciences in connection with each other, and be enabled to explain something of the laws which influence the geographical distribution of plants and animals.—J. F. R.

nigro-picum punctatum æneo submicans; segmento penultimo lateraliter et angulariter producto (♂) aut simplici (♀). Forceps (♂) niger valde elongatus, gracilis ad basin, valde externè curvatus, in medio, dentibus duobus parvis internis instructus, apice sursum et exterius producto, acuto (♀) elongatus multo gracilior, rufescens fere rectus et inermis.

ORDER LEPIDOPTERA LINN.

DIURNA. FAMILY PAPILIONIDÆ.

PAPILIO MACHAON, Linn.

This handsome butterfly, like Vanessæ Antiopa, and Atalanta, Cynthia Cardui, and some others, affords an instance of wide geographical range,* rather than of representative structure, since the individual figured cannot be regarded as specifically distinct from the European specimens, which differ amongst themselves in various slight particulars, as the size of the dark bars, and spots, &c. It may, however, be noticed, that the specimen figured has the small oval black spot near the extremity of the anterior wings almost entirely isolated, the large basal black portion of the same wings is very strongly covered with yellow powder, whilst the black lunules of the posterior wings are not nearly so much powdered with blue bloom, as in the ordinary English specimens.

FAM. NYMPHALIDÆ.

PAPHIA PARAKEKTA, Horsfield. Lepidopt. Javanica.

Paph. alis anticis ad apicem acutis, posticis subcaudatis; anticis supra ad basin cæruleis, fascia obliqua lata fulva in medio, apiceque nigro; maculisque duabus parvis albis (una discoidali, altera apicali) ornatis; posticis cæruleis.

The preceding characters, drawn from the upper surface of the wings of this remarkable butterfly, will suffice for its determination until the publication of Dr. Horsfield's description. The under surface of the wings are, however, much more remarkable, bearing a most striking resemblance to a pale dried leaf; the deception being much increased by the form of the wings, when brought in contact by the Insect, whilst sitting upon a flower in the sun-shine, the short caudal appendages

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* Messrs. Godart and Latreille, in the Encyclopédie Méthodique (vol. IX., Art. Papillon) state, that Pap. Machaon is found in Syria and Egypt.

giving rise to the idea of the stalk of the leaf, thus completing the delusion.

DIVISION ?———— ? FAM. ZYGÆNIDÆ ?

Genus CAMPYLOTES, Westw.

Genus anomalum Heleonæ et Anthonoyzæ *Sw.* Gymnanto ceræque *Guér*, affine, alæ oblongæ, subovales, integræ, nervis apicalibus valde curvatis, anticæ cellula discoidali clausa nervos duos postice emittens, quorum exterior trifurcatis, posticæ etiam cellula discoidali clausà, nervo recurrente intermedio bifurcato. Corpus parvum abdomine gracili, pone alas haud protenso. Caput parvum. Ocelli 2. Antennæ graciles biramosæ. Palpi brevissimi supra haud discernendi, maxillæ elongatæ spirales.

CAMPYLOTES HISTRIONICUS, Westw. Æneus, alis ad costam rufo—, interne flavo-lineatis, maculisque apicalibus albis.

Long. Corp. lin. 11. Expans. alar. unc. 3. Habitat in Nepalia. Hardwicke ; in Montibus Himalayanis, Royle.

Corpus nigro-æneum, palagris maculisque abdominalibus lateralibus flavis. Alæ anticæ æneæ, costa, fasciisque duabus discoidalibus rufis, fasciiisque tribus internis per totam longitudinem alarum currentibus flavis ; maculis 8 vel 9 (spatium inter nervos apicales occupantibus) albis. Alæ posticæ similiter coloratæ, at maculæ terminales flavo ornantur.

This remarkable Insect appears to be the extreme type of a very numerous Indian group of Lepidoptera, to which belong the species named Capys pectinicornis, Thallo, and Rhodope. It is impossible to decide upon their real affinities, until we obtain a knowledge of the metamorphoses of some of the species.

ORDER ORTHOPTERA. FAM. MANTIDÆ.

MANTIS Roylii. Hope, MSS.

ORDER HYMENOPTERA. Section PUPIVORA.

FAM. CHALCIDIDÆ.

DIRRHINUS HIMALAYANUS, Westw.

Niger, pedibus 4 anterioribus, tarsisque posticis rufescentibus.

Capite obtuse bicornuto.

Habitat in Himalaya.

Long. corp. lin. 2. Exp. alar. lin. 3.

Caput nigrum punctatum, anticé obtusé bicornutum antennarum articulo primo nigro (articulis reliquis deteritis). Thorax fortiter punctatus; metathorace 4 lineato et ad latera, angulariter producto. Abdomen breve depressum thoracis latitudine. Pedes 4 anteriores rufescentes, 2 postici nigri, tarsis solummodo rufescentibus.

Obs. In hac specie partes oris valde elongatæ, labro oblongo-ovali ciliato, mandibulis inter se similibus, gracilibus, sub apice dente interno unico armatis.

ORDER HETEROPTERA. Section Longilabres.

Fam. Scutelleridæ,

Scutellera Pulchella, Hope, MSS.

Cæruleo-nigra vel-æneo, nitida prothoracis disco anticé, et margine postico æneo vel cupreo tincto, scutello aureo viridique intenti, fascia transversa basali, alteraque centrali obliqua, (in medio interrupta) et maculis tribus rotundatis (postice et in triangulum positis) cæruleo-nigris.

Statura fere Scutelleræ mauræ at paullo minor, scutelloque abdomen omnino obtegenti. Scutelleræ Stockeri affinis at robustior. Antennæ articulis duobus basalibus brevibus equalibus. 3tio. 2do. fere duplo longiori, ultimo omnium longissimo.

Long. corp. lin. 5. lat. lin. 3.

Fam. Pentatomidæ.

Megarhynchus Transversalis, Westw.

Fusco-niger, capite acuté bicornuto, angulisque anticis thoracis acuté antice productis, prothorace et scutello transverse striatis, parte coriacea hemelytrorum nigrâ, tenuissime punctata, membranâ apicali albida, antennæ et pedes nigri.

Long. corp. lin. 7½. lat. lin. 3½.

ORDER HOMOPTERA. Section Saltatoria.

Fam. Acadidæ.

Cicada Sulphurea, Hope, MSS.

Nigra, capite thoraceque sulphureo maculatis, alarum dimidio basali sulphureo, parte anticarum sulphurea, fascia obliqua nigricanti divisa, apicibusque fuscescentibus.

Long. corp. unc. 1½. Expans. alar. unc. 3¾.

Affinis Cicadæ maculatæ. Caput nigrum orbitu interno oculorum sulphureo ; thorax niger maculis 8 sulphureis abdomen nigrum segmentorum marginibus pallidis. Alæ anticæ costâ sulphureâ, maculâque ovali maximâ (plus quam dimidium basale alarum occupante) sulphureâ fasciâ obliqua tenui nigrâ internè dentatâ divisâ ; apice fusco nervis nigris Alæ posticæ ad basin sulphureæ, ad apicem fuscæ nervis nigris ; pedes nigri

ORDER DIPTERA. Section PUPIPARA.

FAM. HIPPOBOSCIDÆ.

HIPPOBOSCA MACULATA.

Thorace fusco, flavo variegato, scutello nigricanti, maculis tribus flavis, mediâ majori, femoribus tibiisque posticis ad apicem fuscis.

Hippobosca equina ; " ex Indiâ orientali paullo major, thoraceque magis albo variegato, at vix distincta." Fab. Syst. Antl. p. 338.

Hippobosca maculata, Leach, " On the genera and species of Eproboscideous Insects." Wernerian Trans. vol. ii. p. 549.

Long. corp. lin. 4 Expans. alar. lin. 8¾.

Caput flavum, oculis fulvis, lineâ longitudinali inter oculos fuscâ. Proboscis nigra. Thorax fuscus, maculâ magnâ ad angulos anticos flavescenti in medio fuscâ ; fascia parva centrali lunulisque duabus in medio conjunctis posticis flavescentibus, scutello nigricante maculis tribus flavis media majori. Abdomen fuscum, punctatum, marginibus rufescentibus. Pedes fulvescentes tarsis omnibus femoribus tibiisque posticis ad apicem fuscis.

FAM. NYCTERIBIDÆ.

NYCTERIBIA ROYLII.

Obscure nigra pedibus fuscescentibus elongatis, vix compressis, coxis anticis brevibus, abdomine ovalo, conico, depresso, 5-articulato, apice subtruncato, stylis duobus incurvis subtus armato, capite compresso.

Long. corp. lin. 1⅓.

Habitat in Indiâ Orentali.

Nyct. Roylii. Westw. in Trans. Zool. Soc. 1. p. 290-5.

ORDER COLEOPTERA.

CETONIA ROYLII, Hope.

Long. lin. 12. lat. lin. 6.

Nigro-viridis thorace flavo marginato elytrisque quatuor maculis flavis notatis. Clypeus quadratus. Antennæ nigræ. Caput quadratum punctatum. Thorax cupreis marginibus externis elevatis, lineaque flava utrinque externa, disco fortissime punctato. Scutellum magnum postice decitum. Elytra nigro-virescentia maculis quatuor flavis notata, binæ fere rotundatæ ad basin positæ, binæ aliæ reniformes ante apicem locatæ. Corpus infra nigro-æneum segmentis abdominis utrinque aurantiis capillis obsitis pedibusque concoloribus.

In Mus. Dom. Royle; in montibus Himalayæ captus ceria.

GEOTRUPES ORIENTALIS.

Long. lin. 10. lat. lin. 6½.

Violaceus thorace sparsim punctulato, elytris striatopunctatis, pedibus supra nigris, infra violaceis nitidis. Antennæ piceæ capitulo fuscanti, thorax violaceus longitudinali seric punctorum in medio posita, variis aliis sparsim dispositis. Elytra striato punctata striis quasi vermibus erosis. Corpus infra violaceum nitidum, femoribus posticis uni-spinosis, tibiis pilosis, tarsis chelisque piceis.

This singular species approaches very closely to some of our British species, and is probably from a high elevation of the Himalayan mountains.

In Mus. Dom. Royle.

ONTHOPHAGUS PHANŒOIDES.

Long. lin. 4½. lat. lin. 2¼.

Niger obscurus, clypeo cornu reflexo abrupte truncato, thorace phanæoformi, postice lateribus in spinam obtusam productis, femoribus luteis. Antennæ piceæ capitulo fuscanti: clypeus hexagonus cornu reverso abrupte truncato, thorax fere quadratus; punctatissimus, punctulis erosis tuberculo antice, fossulaque postice in medio marginis impressa, angulis posticis in spinas productis. Scutellum parvum nitidum. Elytra striata. Corpus suptus atrum nitidum punctatum. Pedes femoribus luteis, tibiis tarsisque nigropiceis.

This singular Insect will, at some future period, form the type of a new genus: in form it unites the South American Phanæus, and the widely-disseminated genus Onthophagus.

LUCANUS LUNIFER.

Long. lin. 37. lat. lin. 10.

Æneo-piceus, areolo tomento aspersus, mandibulis exsertis unidentatis, denticulisque minoribus instructis, apice bifurcatis. Clypeo deflexo lunifero, femoribus castaneis.

Hab. in Montibus Himalayæ; in Mus. Dom. Royle.

This Insect appears to unite in itself the characters of the Asiatic and

European species, the latter rather predominating over the former: it is one of the finest forms of the Himalayan Fauna.

LAMIA WALLICHII.

Long. lin. 16. lat. lin. 5.

Viridisericeus, Antennis penicillatis, elytris tribus fasciis nigris, binisque penicillis dosalibus ornatis. Antennæ corpore longiores et nigro-virides, primo articulo subpenicillato, tribus sequentibus atris, penicillis magnis pilorum barbatis, et reliquis pubescentibus, ultimo tamen pubescentia densiori tecto. Thorax viridis, spinosus. Elytra ornata tribus fasciis vix suturam attingentibus, una in medio elytrorum, secunda inter mediam et apicem, tertiaque binis penicillis dorsalibus interrupta. Corpus subtus nigro-virens, sanguinea pubescentia aspersum. Segmenta quatuor abdominis sanguineo colore fucata, ultimum omne autem viride et nitidum. Pedes viridi-pubescentes, femoribus maculâ rufâ notatis tarsisque infra flavis.

It is impossible to describe accurately the beauty of this Insect ; the sericeous covering, in different lights, imitating the various tints of opal, while the dark fasciæ flash with the iridescence of Labrador felspar.

PORUS, Hope.

STENIDÆ, ML.
LONGIPALPI, Lat.

Corpus oblongum fere parallelum subdepressum. Caput mediocre oculis magnis lateralibus. Antenuæ crassæ articulis transversis. Mandibulæ acutæ dente interiori armatæ. Labrum transversum integrum ciliatum. Maxillæ elongatæ bilobatæ. Palpi maxillares longitudine mediocres articulo 3tio. longo clavato, ultimo minimo. Labium elongatum apice lanceolato, paraglossis lateralibus. Palpi labiales breves, articulo ultimo parvo conico. Thorax fere circularis. Abdomen elongatum marginatum. Pedes simplices. Tibiæ calcaribus binis armatæ Tarsis articulis simplicibus.

PORUS OCHRACEUS. Long. lin. 4. lat. lin. ¾.

Elytris punctatis antennis fuscis, mandibulisque ad apicem nigris.

Hab. in Montibus Himalayæ ; in Mus. Dom. Royle.

This genus somewhat approaches our European Evæsthetus.

APHODIUS.

APHODIUS IRREGULARIS, Hope.

Long. lin. 4. lat. lin. 2.

Flavus thorace nigro, elytris subaurantiis, fascia media maculis quatuor nigris, pedibusque piceis. Antennæ piceo capitulo fusco. Caput angulis anticis oblique truncatis. Thorax niger nitidus punctatus, angulis anterioribus flavis. Elytra flava, seu subaurantia, fasciâ mediâ irregulari nigrâ, binis maculis humeralibus, binisque aliis fere ad apicem locatis concoloribus.

Hab. in Montibus Himalayæ; in Mus. Dom. Royle.

ANISOTELUS, Hope:

TELEPHORIDÆ.

Antennæ articulo Imo. crasso, reliquis multo crassiori, 9-10 obconices magnitudine paululum crescentibus ultimo majori ovato apice acuto. Mandibulæ valde acutæ. Maxillæ membranaceæ lobo unico intus tomentoso. Palpi articulo 1mo. minimo, 2do. et quarto æqualibus, ultimo subsecuriforme. Mentum transversum. Labrum membranaceum fere rotundatum. Palpi labiales breves, articulo ultimo majori securiformi. Caput transversum oculis prominulis. Thorax transversus lateribus rotundatis, angulis posticis acutis elevatis. Elytra sicut in Telephoris, in medio nonnihil dilatata. Tarsi 5-articulati, articulo penultimo bilobato.

ANISOTELUS BIMACULATUS, Hope.

Long. lin. 4½., lat. lin. 2.

Lividus, elytris 2-maculatis. Antennæ articulo primo testaceo, reliquis fuscis. Thorax rufo-testaceus nitidus, elytris pallidioribus macula ovali nigra in singulo fere ad apicem posita. Corpus infra testaceum.

Hab. in Montibus Himalayæ; in Mus. Dom. Royle.

ELATER CYANOPTERUS, Hope.

Long. lin. 4½., lat. lin. 1¼.

Cyaneus, antennis fuscis, marginibus thoracis pedibusque rubris. Caput nigrum antennis fuscis. Thorax in medio nigro-cyaneus, marginibus lateralibus rubris. Elytra striato-punctata subpubescentia. Pedes rubris.

Hab. in Montibus Himalayæ; in Mus. Dom. Royle.

RIPIPHORUS APICALIS.

Long. lin. 3., lat. lin. 1.

Rufus, thorace pedibusque nigris, elytris flavo-rufis quatuor maculis notatis. Caput atrum ramo antennarum piceo, foliisque nigris. Thorax concolor. Elytra flavo-rufa, basi nigrofasciata, maculis binis fere mediis, apicibusque corporeque infra nigris.

Hab. in Montibus Himalayæ; in Mus. Dom. Royle.—*Royle's Illustrations of the Botany, &c. of the Himalayan Mountains, Supplementary Part.*

(In connexion with the foregoing the following *Desiderata in the Entomology of India*, by the Rev. F. W. Hope, are republished from the *Calcutta Journal of Natural History*. No. 1.)

1.—Parasites of Birds, Lice, (*Nirmi*). Parasites of *Reptilia* (*Acari*) the name of the genus and species should be given on which they are found. Parasites of Quadrupeds, Ticks, &c.

2.—Endeavour to ascertain if the larger Beetles of India live more than one year; it is important also to ascertain the sexes of the *Atlas Beetles*, and the uses to which their horns are applied.

3 —Ascertain the names of the trees which yield *Resin Anime*; and if any other resins in India contain insects.

4.—Among *Coleoptera*, attend chiefly to the *Lamellicorn Beetles*, *Cetonia*, *Copris*, *Scarabæus*, and *Baprestidæ*.

5.—Ascertain by dissection of gigantic *Coleoptera* if the organs of hearing are in the basis of the antennæ as in *Crustacea*; collect the larvæ of all large *Beetles*, and try if they have the power of hearing.

6.—Send me an account of the habits of *Paussus*, and all the species you can obtain.

7.—Any species of insects infested with worms, should be noticed. The worms should have drawings made of them before put into spirits.

8.—All hermaphrodite insects to be noticed, as well as irregular copulation of different genera.

9.—All *Carrion Beetles* to be attended to. They are supposed to be *scarce* in India. The prejudice of caste and of religion will not allow many of the natives to touch a dead body of any animal.

10.—All species of silk-bearing insects used in commerce, with their local names and larva, eggs, &c. It is probable we may breed the Atlas Moths in England. Send Larvæ of any, placed in mould, when an opportunity occurs. Colonel Withill introduced alive into England *Bombyx Selene*. Any reports of the annual produce of silk useful.

11.—*Cochineal*, new species; intelligence wanted about its range. How many species in commerce in India. *Lac insect* also.

12.—*Bees*. All species of Bees to be collected. Any accounts of the produce of honey. The *native names* of Bees much wanted; any thing remarkable in the combs to be figured. All *parasite beetles* found in Bees' nests much wanted. Imports and exports of honey and wax. What are the Bees which produce the wax of the Chinese candles? there are several sorts.

13.—*Ants*. Collect all species of Ants—males, females, and neuters. Ascertain if they *lay up* stores of grain, seeds, &c.; be careful in marking the species. What Ants will drive out the White-Ants? Are the different kinds employed by the natives, to drive out those which annoy them? Experiment on the formic acid. If the White-Ants' nests are ever used as ovens.

14.—*White-Ants.* Collect all species; attend to their parasites, particularly the *Beetles*, which attack them, and are found in their nests.

15.—What insects are eaten as food? Their Indian names. What *Locusts* are eaten, &c.?

16.—Mark those insects which cause any particular destruction of crops, and if the destruction is periodical.

17.—Mark all *luminous* insects. Ascertain if the *Lantern Fly* is *luminous*, it is disputed.

18.—What species of *Mygale* are in India? Their habits. What spiders yield silks, such as are found in commerce?

19.—What species of vesicatory insects are used in India? If any besides *Lytta* and *Mylabris*. If any insects are used medicinally. Their names.

20. Record any instance of death occasioned by insects, by Bees, Wasps, Hornets, or by Flyblowing, &c. Any ailments produced by insects swallowed in the larva state, &c.

21.—Is *Resine Anime* a preservative against the attacks of insects? Said to be used in corking bottles. Is cloth *coloured by Indigo* ever attacked by the White-Ants and other insects?

22.—Any native remedies against Cockroaches? Collect all species of, and particularly all sorts of *Earwigs*.

23.—Native remedies used after the stings of insects, and the attacks of Gnats, Scorpions, Centipedes, &c.

24.—Note all insects infesting houses. Does any true *Ptinus* occur in the East Indies?

25.—Species of *Æstrus* attacking quadrupeds; collect them. Do any attack man in the East?

26.—Collect all Aquatic Beetles. Do the *Gyrene* of India emit a peculiar smell? Do the *Carabe* emit an ammoniacal odour?

27.— Collect all Land-Crabs and inland *Crustacea.*

28.—Observe particularly the insects which destroy corn, rice, and all stores. What checks are in use?

29.—Note any extraordinary migration of Caterpillars, and indeed of all other insects.

30.—The *Mole Cricket* of the East Indies. What are its habits?

31.—Note the appearance of the clouds of Locusts.

32.—What are the preservatives used by the Indians in guarding their feathers and shawls? Colocynth supposed to be used.

33.—What genera and species of insects are used by the natives, in necklaces and ornaments, &c.?

34.—The habits of the large *Stag Beetles*. Do they destroy leaves?

35.—Note all odorous smelling insects.

36.—Are Beehives in use in India? Send specimens of domestic Bees, if they are domesticated.

37.—Is the *Sherifah*, or Custard-Apple seed, injurious to vermin? Flies are reported never to settle on the tree or its fruits. Ants will attack both.

38.—From what quarters chiefly do clouds of Locusts come?

IX.—*Memoir on the Mammalogy of the Himalayas.—By* WM. OGILBY, ESQ., M.A., *Fellow of the Royal Astronomical, Geological, Linnæan, and Statistical Societies; Secretary of the Zoological Society.*

In the early part of the year 1833, Professor Royle put into my hands an extensive Collection of Zoological Specimens, made during his excursions through the Western parts of the Himalayan Mountains, of which the rich Botanical results are now in course of publication, with a request that I would furnish him with a Catalogue *Raisonnée* of the different species of which it contained the spoils, to be added as an Appendix to his work. Whilst occupied in this easy and unostentatious task, various observations presented themselves, which induced me to propose to my friend a slight alteration of his original plan, so as to embrace a general outline of the Mammalogy of the Mountain Regions of Northern India, for the purpose of exhibiting, at one view, the intimate relations which I soon perceived to subsist between the animal productions of this elevated and extensive mountain chain and those of Northern Europe, Asia, and America. It soon became obvious, in fact, that the Zoology, like the Botany of the Hills, differed essentially from that of the sultry plains of India, which skirt their southern base; that, though occasionally mixed with tropical forms, it was, upon the whole, of a character closely resembling that of the more temperate and northern latitudes; and that the insulated position of these remarkable mountains, exhibiting, as they do, the rare and interesting phenomenon of a temperate and even a boreal climate on the very confines of the tropic, where the summer heat is necessarily greater than even under the equator itself, gave an importance to the inquiry, as connected with the geographical distribution of Animal Life, which promised the most important results. The nature of the problem, indeed, and the very different conditions of Animal Life, as compared with that of Vegetables, forbade me to anticipate the discovery of laws of distribution in the Animal Kingdom, so definite and circumscribed as those which Baron Humboldt has established with regard to Plants; the principle of animality, if I may be allowed the expression, possesses an innate power of adaptation which renders Animals in some measure independent of climate, particularly as compared with Vegetables, and which increases in proportion as we ascend in the scale of life; but I felt that if any such laws of geographical distribution prevailed in Zoology, they might naturally be expected to be exhibited most clearly and unequivocally on a theatre like this, and therefore that the opportunity should not be neglected of investigating the circumstances of a problem which appeared to promise so much scientific interest.

From the observation just made, *viz.* that the power which all animals possess, in a greater or less degree, of adapting themselves to different varieties of climate, and of withstanding, uninjured, the effects of temperatures foreign to their natural habits, increases in proportion as we ascend from the lower to the higher tribes, it will be seen that the Mammalia—the class which I had undertaken to review—form one of the most unfavourable groups for the discussion of this important question. Indeed, were it not from their limited powers of locomotion, they would be the very worst of all, because their high position in the scale of life, and the superior intelligence and resources with which it endows them, necessarily protect them against changes and casualties, which would prove fatal to more simply organized beings; but, deprived of the powers of flight, ordinary Mammals have not the means of traversing the wide deserts and oceans, which separate the habitable portions of the earth: the nature of their locomotive powers consequently confines them to particular regions; and, in spite of the more favourable circumstances of their physical organization, their more varied resources and superior intelligence, they afford better materials for studying the problem of geographical distribution, than the kindred class of Birds, whose faculty of rapid flight enables them to set oceans and deserts equally at defiance, in passing to the most distant quarters of the globe, and, as it were, to choose their own temperature and climate in the boundless fields of air. Hence it is that the circumstances of the important problem of geographical distribution are less favourably presented in Ornithology than in Mammalogy; but, with this exception, the observation above made holds good throughout all other classes of animals, and the simplest tribes will always be found to present the most certain results. Insulated families also occasionally occur, which possess peculiar advantages for the prosecution of this inquiry; as, for instance, in the case of fresh-water Fishes, than which I am acquainted with no other group of animals so well calculated to illustrate the laws of geographical distribution, or so likely to repay a careful study under this point of view; and I am only surprised that no competent Ichthyologist has hitherto occupied himself with so promising an inquiry.

The only other principle which can well be regarded as influencing the geographical distribution of Animals, *viz.* the dispersion of Plants, upon which all Animals live, either mediately or immediately, is obviously subordinate to that of climate, with which it has been shown to be most intimately connected. On a limited scale the distribution of particular species may be seriously affected by the influence which civilization and cultivation produce upon the face of particular countries; wild animals necessarily disappear with the woods and forests which afforded them food and shelter; the Wolf, the Bear, and the Beaver, have thus disappeared from our own country; the Capercalzie, exterminated about a century ago, is once more spreading rapidly over the pine forests of Scotland; but these are partial cases, which do not bear upon the general problem of geographical distribution; and it is obvious, that upon the great theatre of nature, climate and temperature are the only laws which regulate it, limited, indeed, by the physical structure of the animals, as has been already observed, and by their powers of transporting themselves to distant regions. Hence it is that terrestrial and fresh-water tribes are more favourable for this study than marine or pelagic; though even among the latter, the comparative simplicity of their structure, and their consequent susceptibility of changes in temperature, render the habits of different genera and species more definite and confined than might otherwise be expected. Of the former, again, land and fresh-water Mollusks being among the most simply organized, are consequently most limited in point of range; the species of Insects are almost equally confined, unless in the case of certain tribes, which are susceptible of being transported to distant countries in wood and other extraneous substances; next follow Reptiles and fresh-water Fishes; and, last of all, Birds and Mammals; the former, as already observed, having an almost unlimited range of habitat, from the facilities which they derive from their powers of flight, of passing to the most distant quarters of the globe. The common Sparrow, the Snipe, and the Woodcock, for instance, are found in the Himalayas and in Japan, as well as in the North of Europe; nature has endowed these birds with means of traversing the arid climes and extensive deserts which intervene between these localities, which she has denied to Quadrupeds; and hence we must not expect to find the Badger and the Fox so widely distributed as the Owl and the wild Goose. But if the same species of Mammals are confined to particular regions, the great question still remains, whether similar regions, wherever situated, or however separated from one another by intervening seas and deserts, produce kindred or analogous species of Mammals ? and it is the general solution of this question in the affirmative, as far at least as the great continents of the globe are concerned, which renders the Mammalogy of the Himalayas so interesting in this point of view. We have here an insulated territory on the confines of the tropic, with a climate varying from the most intense heats of the Equator to the greatest rigours of the Pole; and we shall find, in discussing its animal inhabitants, that it presents, as it were, an epitome of the Mammalogy of the world ; an intermixture, or rather a succession of species and genera similar to that which we meet in travelling from India to Kamtschatka, or from Brazil to Labrador.

Having thus fully explained the objects, it now only remains for me to acknowledge the sources from whence I have derived the materials of the following Memoir. The principal of these has been, of course, the Collection of Professor Royle himself, and the few notes, rendered particularly valuable, however, by containing the native names and localities, made by that gentleman during his tours. Besides which, the extensive Collections of the British Museum, of the Museums of the Zoological Society, the East-India Company, and various private collections of less note, which are occasionally made by Officers, and sent to their friends in this country, many of which I have had the good fortune to examine, have furnished me with valuable materials; whilst the different Notices and Memoirs on Indian Zoology, dispersed through the pages of the Asiatic Researches, the Journal of the Asiatic Society of Bengal, the Zoological Proceedings, and other similar publications, have been consulted with the greatest advantage. By carefully quoting my authorities, I have invariably taken care to distinguish what I have seen or know myself, from what is merely given on the faith of others. Yet with all these resources at my command, I have found my materials much too limited to give any thing beyond a mere outline of the Mammalogy of the Himalayas ; but if this Memoir should prove to be the means of inducing future travellers, or residents, in those interesting regions, to fill up the sketch thus imperfectly traced, or assist them to distinguish what is already well known, from what still continue to be desiderata, in these inquiries, it will not have been without its use. The present time, indeed, is peculiarly favourable for such pursuits. India now contains many able and zealous naturalists; and what is not less fortunate, has a Nobleman for its Supreme Governor who both understands and can appreciate the value of their pursuits. Drs. Cantor, M'Clelland, and Falconer, are skilful and practised observers; and Mr. Hodgson appears only to want access to European libraries and museums, an advantage unfortunately beyond the reach of the Indian Naturalist, to illustrate the Mammalogy of Nepal in the most ample and satisfactory manner.

Before leaving this part of the subject, I shall take the opportunity of offering a few remarks, which may be useful to that numerous class of intelligent and educated gentlemen, who are dispersed over every part of India; and who, from their taste for field sports and the facilities afforded by their situations, have the means of making the most valuable observations in various departments of Natural History; but which are too often neglected, not from any deficiency of zeal or inclination on the part of the observers, but from a want of practical experience in observing, from the difficulty of naming and describing the animals which fall under their notice, and from not knowing exactly what points to attend to. An accurate knowledge of specific differences, however, is by no means indispensable for this purpose; generally speaking, it is sufficient to indicate the affinity of the animal to the most approximate European species, and to ascertain its native name, in order to enable the more practised Zoologist to recognize it with sufficient accuracy, especially if the forms of the feet, teeth, ears, &c. be carefully noted: but the main points to be attended to, and those, unfortunately, which the generality of observers most neglect, are the habits and economy of the animals which fall under their notice; their manners, whether aquatic, arborial or terrestrial; whether they inhabit burrows, or reside among thick jungle, or on the naked open plain; whether they live in society or solitary; the number of young which they produce at a birth; their period of gestation; the duration of life; their instincts, and the stratagems which they employ to capture their prey or to escape from their enemies; the nature of their food; whether they hibernate or migrate from place to place, according to the season; whether they are turned to any account by the natives, or are capable of yielding any products applicable to the purposes of commerce or domestic economy. These, and other similar inquiries, of the utmost importance to the philosophical Zoologist, are within the ordinary range of daily observation to most gentlemen in India, with respect to many rare and interesting animals; whilst they are, generally speaking, attended with so little trouble, and at the same time productive of so much mental recreation and instruction, that it is only surprising how much they have been heretofore neglected. One principal cause of the apathy which our countrymen in India have shown, if not in making, at least in recording, their observations on various branches of Natural History, may, indeed, have arisen from the want of some common central institution, where they could be properly arranged and published; but the establishment of the Zoological Society of London, and the unrivalled resources which it possesses, offer facilities for this purpose, which it is hoped will hereafter be made extensively available by Englishmen in all parts of the world. It is scarcely necessary to add, that any interesting details relative to the habits and manners of foreign animals, observed in their native climates, will be gladly received from any quarter, and published in the Proceedings of the Society; especially if accompanied by the skins of the animals (the skulls, legs, and tail, being carefully preserved), for the purpose of identification. The Journal of the Asiatic Society contains numerous articles on Natural History, but its contributions in this department are fewer than could be wished: whilst the Bengal Sporting Magazine, hitherto in a great measure confined to mere journals of shooting excursions, might likewise be made a ready and appropriate medium for the publication of such observations; and the contributions of its various correspondents prove them abundantly qualified for this higher and more important object.

These introductory observations being premised, I shall now proceed to enumerate such Mammals as I know to inhabit the great Himalayan Chain; and without following any formal arrangement, shall throw them into such natural groups or families, as appear best suited to illustrate their geographical distribution with respect to climate and temperature, the principal object of the present Memoir.

QUADRUMANA.

Throughout Bengal and the nothern provinces of British India, there appear to be only two species of *Simiæ*, the Hoonuman (*Semnopithecus Entellus*), and the Bhunder (*Papio Rhesus*); both of which ascend the hills to a very considerable elevation during the summer heats, and return again to the plains at the commencement of the cold season. This migration is a very interesting fact in the history of these *Simiæ*; it is the only instance of a similar phenomenon, which has been recorded of this family of Mammals, and may become of great value in its application to geological reasoning on the climate and temperature of Europe during the tertiary epochs, in the deposits of which periods the bones of Apes and Monkeys have lately been found, associated with the remains of Pachydermata, and other inhabitants of more tropical latitudes. The Hoonuman, called *Lungoor* by the Hill tribes, is not unfrequently found at an elevation of from 9,000 to 11,000 feet, as among the Pine forests in the neighbourhood of Choor, and sometimes even at the verge of the snow-line. Nay, it even appears to have succeeded in crossing the mountains; Turner[*] mentions having seen a large troop of these monkeys in Bootan, where they are held in the same veneration as in Hindustan; and that it has found its way, and is capable of subsisting in a state of nature, at a considerable elevation, and a comparatively low temperature, is sufficiently evinced by these facts, as well as by the testimony of Fraser,[†] Traill[‡] and other intelligent travellers. Dr. Royle found it common enough in the neighbourhood of Hurdwar in April, and on Tuen and Manma at 9,000 feet of elevation in the latter end of May and in June.

The Bhunder, Bender, or Bandar, the Common Monkey of Bengal and Upper India (*Papio Rhesus*), though said by Mr. Hodgson to exist in the central regions of Nepal, only in the vicinity of the temples, and in a semi-domestic state, whence he conjectures it to have been introduced from religious motives, is also reported to abound in Kumaon; and it is highly probable, that the nearly allied species (*Papio Assamensis*) lately discovered by Mr. M'Clelland in Assam, ascends the more eastern hills, as its congener does the central and western ranges. Of this, however, we have no positive knowledge, though the close affinity of the animals gives a strong degree of probability to the fact; but the various species of Monkeys which Mr. Fraser thinks may be found along the upper courses of the Jumna and Ganges, rest on more questionable authority; and it is not unlikely that this intelligent traveller, as indeed he has himself conjectured, was deceived by distance, variety of size, and other circumstances, which give a very different appearance to individuals of the same species. Mr. Hodgson[§] gives the Bonnet Monkey (*Cercopithecus radiatus*) as a native of Nepal; but this species is confined, as far as at present known, to the Peninsula and western coast of India, and seems to have been confounded by Mr. H. with the *Papio Rhesus*, or Bhunder of Hindustan. The same gentleman, in a letter to the Zoological Society, written some years ago, mentions that his shooters were once alarmed in the Kachar, or Alpine regions of Nepal, by the appearance of a wild man, which walked erect, was covered with long dark hair, and had no tail. The improbability of finding a real Ape in such a situation led him to question the truth of the report; but it is well known that the woods of the lower ranges to the east of Nepal contain at least one species of Gibbon, *Hylobates Scyritus*, called *Hooloo* or *Hooloc* by the Assamese; and it is not improbable that individuals may occasionally wander to the higher and more remote forests of the Central Hills.

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[*] Journey to Thibet, p. 147. [†] Journey in the Himalayas. p 351.

[‡] Asiat. Res. XVI. 153.

[§] Proc. Zool. Soc. II. 96.

CHEIROPTERA.

When it is recollected that of the sixteen species of Bats, now known to inhabit the British islands, no fewer than ten have been discovered within the last few years, it will not appear surprising that we should be so imperfectly acquainted with this department of Himalayan Mammalogy. Mr. Hodgson, indeed, is the only author who has furnished us with any details on the subject: his "Synopsis of the Vespertilionidæ of Nepal," published in the Journal of the Asiatic Society of Bengal, vol. iv. p. 699, contains an enumeration of seven species of *Cheiroptera*: but, as he himself very candidly observes, his specific identifications must be received with considerable caution, from his want of access to extensive libraries and museums, for the purpose of comparison. Of the two species of *Pteropus*, for instance, which he has there briefly described under the names of *P. leucocephalus* and *P. pyrivorus*, the former does not appear to differ from the *P. medius* or *Edwardsii* of the Plains; and the probability of its identity with that species is increased by the fact, which Mr. Hodgson mentions, of its only visiting the temperate regions of Nepal during the autumn, returning of course to the more sultry plains of India on the approach of the cold season. The *Pteropus rubicollis* of Mr. M'Clelland's "list of objects of Natural History collected in Assam," is likewise identical with the *P. Edwardsii.* The only other species of tailless *Pteropus* known to inhabit the continent of India, *Pteropus Dussumieri*, is very different in its characters from *Pteropus medius;* and as Dr. Royle brought undoubted specimens of this latter species from the lower hills a little farther west, it is but reasonable to suppose that it is equally common in Nepal, and consequently identical with Mr. Hodgson's animal. The *Pteropus pyrivorus*, to judge from the short description given by Mr. Hodgson, appears to be less questionably a new species: it belongs to the second section of the genus, having a short tail, partly free and partly enveloped in the membrane, and derives its specific name from the depredations which it commits among the ripe pears in the central regions of Nepal. The migratory habits ascribed to these *Pteropi* are common to the *Pteropus poliocephalus* of New South Wales, and many other species of the same genus; for these large frugivorous *Cheiroptera* are essentially tropical in their habitats, and only visit more temperate climates during the summer and autumn heats, when the ripe fruits tempt them to wander from their native regions. They are consequently but occasional visitors to the higher elevations and latitudes of the globe ; and the *Pteropus dasymallus* and *Pteropus pselaphon*, which have been hitherto observed only in Japan, comparatively a high latitude for these animals, do not probably form an exception to the general law.

Of the *Insectivorous Cheiroptera*, a family far more abundantly and extensively dispersed over the surface of the globe, Mr. Hodgson indicates only five species as natives of Nepal. Three of these are described as *Vespertiliones*, by the specific names of *formosa*, *fuliginosa*, and *labiata*, and two as *Rhinolophi*, by the names of *armiger* and *tragatus* respectively ; but without a more careful examination and comparison with other species than Mr. Hodgson had it in his power to make, it is impossible to say how far these Bats may be distinct from, or identical with, species already described. One thing at least is certain, that the temperate and more elevated regions of the Himalayas must contain many species of *Insectivorous Cheiroptera*, still unknown or undistinguished, besides those enumerated by Mr. Hodgson ; it has been already observed, that this section of the family is very widely and generally distributed in temperate climates ; and the rich harvest which has attended the researches of British naturalists, within the last few years, in their own country, ought to stimulate our Indian brethren to a pursuit which cannot fail to be rewarded by still more extensive discoveries. It would be extremely interesting, for example, to procure a complete series of Himalayan Bats, with the seasons, temperatures, and elevations at which they were captured carefully noted down, so as to compare them with analogous species of higher latitudes, and thus ascertain what law of succession the different forms may follow, or within what limits they may be confined in respect to temperature, in their geographical distribution over the surface of the earth. Speaking of these *Insectivorous Bats*, Mr. Hodgson observes, that " they are neither migratory nor subject to hibernation ;" two properties which in more northern climates would be considered incompatible with one another, and which even in the central regions of the Himalayas require a very careful revision before they can be admitted as established facts. I am not aware that these animals ever migrate in any climate ; hibernation is the resource which nature has provided to preserve them during the season when their natural food disappears ; and it is the general opinion, that even within the tropics, the Insect-feeding Bats go to sleep at certain seasons, as they do throughout the winter in more northern latitudes : should the fact be otherwise, it would prove a highly interesting addition to our knowledge of their habits; but it is possible that Mr. Hodgson may have been led into error, by the casual appearance of a few individuals during an occasional fine evening, as sometimes occurs in Britain even in the depth of winter. The subject is well worth the attention of Indian Zoologists.

INSECTIVORA.

Ascending gradually from the *frugivorous Cheiroptera* of the Plains of India, which visit the hills only during the summer heats, through the insectivorous genera of the same family, which remain throughout the whole year, we next come to the *Insectivora*, properly so called ; a family which belongs almost exclusively to the temperate regions of the earth ; and of which it is therefore extremely interesting to find the common forms of Europe and Northern Asia occurring in the analogous climates of the Himalayas. No fewer than three distinct species of Hedgehogs, for instance, have been described from the Western Hills :

Erinaceus spatangus, a small dark-coloured species, not more than twice the size of a large mouse ;

Erinaceus Grayii, of a grizzled black and yellow, from the spines being annulated with these two colours, rather smaller than the common European species ; and

Erinaceus collaris, by some supposed to be identical with *E. Grayii*, but easily distinguished by a white collar half surrounding the neck. All these species, however, require a careful revision ; they are founded on single specimens, those of the two former deposited in the Zoological Society's Collection, that of the last in the British Museum, and of which a figure is published in the Indian Zoology of Messrs. Hardwicke and Gray. It is possible that more extensive and accurate observation may prove the whole three to be identical : at all events, it is certain that one, either of these, or a different species (*Erinaceus indicus* of Royle's Illustrations, &c. p. 6), inhabits the neighbourhood of Delhi, where it would be interesting to observe the phenomena attending its hibernation, such as the temperature of its body, the nature of its respiration, &c. during the period of repose. Mr. Hodgson, in the letter to the Zoological Society, already referred to, denies that there are any Hedgehogs in Nepal, but mentions a small dull slaty-blue variety of the common Indian Shrew or Musk Rat (*Sorex indicus*), as common in the lower and central regions, to which he speaks of it as being confined. Other species no doubt exist in the more temperate parts of the mountains, though their small size and shy habits screen them from observation. The same gentleman mentions the Mole (*Talpa*), as abounding in the Káchar, or northern region of Nepal, and Traill* says it is common in Kemaon; but no one appears to have described, or even examined it, and we are ignorant of every thing relating to it, except the name. It will probably prove to be a distinct species from its European congener, if it exist at all; but the question is involved in great doubt, and is well worthy of a careful examination.

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* Asiatic Researches, vol. xvi. 153.

CARNIVORA PLANTIGRADA.

Of this family, the majority of which likewise belong to the temperate regions of the earth, various forms and species occur among the Himalayas. First, of the genus *Ursus*, we have the *Bhaloo*, or Common Bear of India (*Ursus labiatus*), and, according to Mr. Hodgson,* the Malay Bear (*Ursus Malayanus*), inhabiting the Turai, or sultry regions, at the base of the mountains, to which localities he appears to intimate that they are confined. But the habitat here assigned to the Malay Bear is extremely doubtful. It rests solely on the authority of Mr. Hodgson, who, from the want of proper means of comparison, is often mistaken in the identification of species; moreover, we have never received this animal from any part of Continental India, but only from the great islands of the Indian Archipelago; and it is therefore not improbable that it may have been in this instance confounded with the *Ursus Thibetanus*, which, from the general similarity of the two species, may have readily happened. Mr. Hodgson, indeed, expressly mentions this latter species as an inhabitant of the Central and Northern regions of Nepal; and Dr. Royle informs me, that it is confined among the more western hills, to the Doon and warm valleys, where it is called Reech by the natives. Lieut. T. Smith, of the 15th regiment N. I., however, an officer well acquainted with the Mammals of the Himalayas, and a keen sportsman, assures me that the Common Sloth Bear (*Ursus labiatus*) does not ascend above the lower spurs of the great Mountain Chain of Northern India; that it is there replaced by the *Reech* or *Reek*, which occupies the whole of the more elevated hills, as far up as the snow line, where it is succeeded in its turn by the *Barji* or Yellow Bear (*Ursus isabellinus*), a species hitherto very imperfectly described, though mentioned by every tourist as extremely abundant in the higher regions of the Himalayas. Capt. Skinner† met with it in the neighbourhood of Bhairo Ghati; Traill‡ found it in Kemaon, though he says it is peculiar to Bhot; and it is probably the Brown Bear mentioned by Mr. Fraser:§ so that upon the whole it appears, that whilst the

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* Proc. Zool. Soc., ii. 96.

† Excursions, &c. ii. 72.

‡ Asiat. Res., xvii. 16.

§ Journey, &c. p. 351.

Common Sloth Bear (*Ursus labiatus*) is on all hands admitted to be confined to the sultry plains of India, the Reech (*Ursus thibetanus*) succeeds it, as the legitimate representative of the European Bear (*Ursus Arctos*), and of its American analogue (*Ursus americanus*), in the middle or temperate regions of the hills, to be itself replaced among the frozen peaks of the higher mountains, by the *Barji*, or Yellow Bear of the Himalayas (*Ursus isabellinus*), a species in all respects analogous, in its colour and habitat, as well as in its decidedly carnivorous appetite, to its congener, the Polar or Sea Bear of the North (*Ursus maritimus*).

Various animals, either belonging or closely allied to the Gluttons and Badgers (*Gulo* and *Meles*), pre-eminently northern forms, likewise inhabit the elevated ranges of the Himalayas. Among the lower terraces we have the Ratel (*Rattelus mellivorous*), called *Peejoo* by the Hindoos, which is common over all the plains of Northern India, and differs from the same animal, as found at the Cape of Good Hope, only in being of a lighter colour on the back. This wide distribution of the *Carnivora*, and the common occurrence of the same species in India, and the most remote parts of Africa, will be more particularly mentioned in the following article: Mr. Hodgson,* under the erroneous impression that the Peejoo, which the Nepalese call *Bharsiah*, was an unknown animal, and evidently misled by some imperfect or faulty account of its dentition, has recently described it as a new genus under the name of *Ursitaxus inauritus*; but the species has long been well known in Europe. M. F. Cuvier figured, and accurately described its teeth in the "Dents des Mammiferes," so long ago as the year 1825; and the late Mr. Bennett described and figured the animal itself in 1830, from an Indian specimen then living in the menagerie of the Zoological Society.† The *Balloo-soor*, (perhaps more properly *Bhalloo-soor ?*), *Meles collaris*,‡ which M. F. Cuvier likewise elevated to the rank of a generic form, under the name of *Arctonyx*, upon the faith of a distorted native drawing sent to him by M. Duvaucel, is a real *Badger*, and was described and figured by the celebrated Bewick, at least thirty years before M. Duvaucel's visit to India. It inhabits the northern plains of Hindostan, and probably ascends the hills, but of this fact I have no certain information. Of the Gluttons, properly so called, the *Gulo nepalensis* of Mr. Hodgson, which does not differ specifically from the *Gulo orientalis* of Dr. Horsfield, the only distinction being in a lighter shade of ground colour, inhabits the lower terraces of the hills; whilst the *Wah*, or *Chitwah* (*Ailurus fulgens*) and the *Benturong* (*Arctitis Albifrons*)* are said to be confined to the Kachar, and regions bordering on the snow-line. As regards the *Wah*, there is no doubt about the truth of the habitat here assigned to it; but the *Benturong* is a native of the Indian Archipelago, and of the Peninsula of Malacca; and I strongly suspect, that it has been confounded with some other animal, perhaps with *Paradoxurus bondar*, or some closely allied species. The habitat of *Bootan*, assigned to it in the *Regne Animal*, is altogether erroneous. Messrs. Gray and Isidore Geoffroy have proposed to consider the *Gulo nepalensis* as the type of a new genus, the former under the name of *Helictis moschata*, the latter under that of *Melogale personata*.

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* Res. Asiat. Soc. xix., and Journal of Asiat. Soc., v. 671.

† Gard. and Menag., &c. i. 13.

‡ Penny Cyclopædia, iii. 264.

CARNIVORA DIGITIGRADA.

It was mentioned incidentally in the preceding article, that many species of *Carnivora* were common to India, and the Continent of Africa; and it is not a little singular, that this migration appears to have proceeded exclusively from west to east, and never in the opposite direction; or, in other words, that whilst the *Carnivora* of Africa have found their way freely into the neighbouring Continent, those of India have never passed the Arabian desert. I do not pretend to account for this. Perhaps it may depend upon the physical character of the two Continents, and the influence which this circumstance exerts in modifying the nature and habits of their respective inhabitants. The Lion of the burning Sahara, for instance, like the wild Taurick or Bedoween of the same regions, would find the parched deserts of Syria and Persia no barrier to his progress towards the East; whilst, on the other hand, the Tiger of the moist jungles of Bengal could no more pass the arid plains of Arabia than the puny and luxurious Hindoo, accustomed to the same humid soil and atmosphere. But whatever may be its cause, the fact itself is as undoubted as it is interesting. The common distribution of the *Ratel* over both Continents has been already mentioned. This animal is spread over the whole of Africa; it is common in every part of the Cape colony, and Denham and Clapperton brought it from Bornou; and though its geographical limits have not been accurately ascertained in Asia, we know that it abounds on the plains of Northern India, which do not differ much in their physical structure from the Karroos of South Africa. So likewise the Lion (*Felis Leo*), the Leopard or Panther, for they are both the same species (*Felis Pardus* and *Leopardus*), the Cheetah (*Felis jubata*), the Persian and Red-eared Lynxes (*Felis Caracal* and *Felis Chaus*), the striped Hyæna (*Hyæna virgata*), and the Jackall (*Canis aureus*), all pre-eminently African species, are found in most parts of India, without offering any striking variety either in form or colour; whilst the Tigers, Wolves, Paradoxures, &c. of the latter country have never passed far to the west of the Indus, and some of these are even without generic representation on the Continent of Africa: nor is it less singular that, as far at least as at present known, this migration should have been confined to the Carnivora. There is not a single authenticated instance of any of the numerous Antelopes in which Africa abounds above all other parts of the world, and which nature has peculiarly adapted to inhabit the most parched and arid deserts, having crossed the Isthmus of Suez, any more than of the various species of Deer so common throughout the whole extent of Asia having migrated in an opposite direction. If the various indications which Mr. Hodgson has given of the occurrence of species known to inhabit the great islands of the Indian Archipelago, and the southern extremity of the Malay Peninsula, such as the Benturong (*Arctitis albifrons*), the Malay Bear (*Ursus malayanus*), and the Javanese Ichneumon (*Herpestes javanica*), in the forests of the Turaï, which skirt the southern foot of the Himalayas, should turn out to be correct, (and it is certain that *Felis minuta* and *Gulo orientalis* are common to both these localities), it would appear that India Proper, besides its own appropriate Mammals, is a kind of neutral ground upon which the species of the most distant countries to the east and west of it meet and mingle together. One fact, abundantly singular, but which I have never seen accounted for, is the alleged total absence of every species of the genus *Canis*, so numerous and so common throughout all parts of India, in Burma, Siam, and those other countries east of the Brahmapootra, which compose the great Malay Peninsula. This is a phenomenon well worth the attention of Indian Naturalists.

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* Mr. Hodgson, in Zool. Proc., ii. 96.

As far as regards the occurrence of the *Digitigrade Carnivora* among the Himalayan Mountains, it is certain that the Lion, called *Baug* by the Indians, ascends the western hills to a very considerable elevation. Mr. Fraser often heard of it during his journey to the sources of the Ganges and Jumna,[*] and Bernier, whilst travelling to Cashmere, in the train of Aurungzebe, had frequent opportunities of witnessing the chace of this animal: the amusement was reserved for the Emperor alone, and the success of a day's sport was recorded by the Imperial Historiographer in the annals of the empire. The same indifference to climate characterises the Lion in Africa; in the time of Herodotus and Aristotle, he was common among the coldest mountains of Macedon; at the present day he is as often found among the snowy peaks of the Atlas, or on the chilly slopes of the Snueuberg, as in the desert of Barca, or on the banks of the Gareip. Travellers should look for him to the east of the Brahmapootra, as though not known to inhabit any part of Eastern India, the Burmese are said to have figures which can be intended for no other animal, and which can only have been drawn from the living model. The Tiger and Leopard are well known to inhabit every part of the Himalayas, even to the line of perpetual congelation: they exist equally in Japan, in the Caucasus, and in the Altai Mountains in Southern Siberia.[†] The Tiger of Bockhara is less than the Bengal variety, and chiefly confined to the Valley of the Oxus;[‡] whilst in Japan he is covered with a thick coat of long soft fur, to protect him from the rigours of that northern climate. The *Cheetah* is said by Mr. Hodgson[§] to occur chiefly among the lower valleys of the Himalayas, but Pallas found it as far north as the Caspian Sea and the deserts of the Khirgis Tartars, so that it may possibly ascend the Hills to a greater height than has yet been suspected. Lieut. Smith mentions a small dark coloured variety of the Leopard, called *Luckur-backer*, extremely fierce, and common in every part of the Hills.

Among the smaller species of the genus *Felis*, the Moormi Cat (*Felis moormunsis*) first described by Mr. Hodgson, and hitherto observed only by that gentleman, as likewise the *Felis Bengalensis* or *nepalensis*, are stated to inhabit the middle terraces of Nepal[§]. The *Felis Viverrinus*, first described by Mr. Bennet[||] in 1833, and three years afterwards by Mr. Hodgson, under the nearly identical name of *Felis Viverriceps*,[¶] inhabits the lower terraces and valleys of the Turaï. *Felis Chaus*, (called

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[*] I beg to observe here, that I frequently made inquiries on this subject, and could never learn anything positive on the subject; nor had any of the numerous sportsmen to whom I spoke on the subject, ever seen a Lion or its skin, obtained from within the Himalayas. At present, the Lion is I believe only found to the west of the Jumna, especially on the edge of the desert, near Hansi. J. F. R.

[†] Pallas Zoog. Ros., i. 16.

[‡] Burnes' Travels, ii. 178.

[§] Zool Proc., ii. 97.

[||] Zool. Proc., i. 68.

[¶] Journal Asiat. Soc., v. 232.

Biraloo in Nepal), of which I have compared numerous African and Indian specimens, extends over every part of the Hills: it is the *Felis erythrotus* of Mr. Hodgson;* and there is a specimen of a Himalayan Cat in the Museum of the Zoological Society, so closely resembling the common Wild Cat of Europe, that it differs only in the absence of the dark transverse and longitudinal stripes which mark that species, and which may not improbably be a mere effect of locality.

Mr. Hodgson† has described three species of Paradoxuri as inhabitants of the Southern, Central, and Northern regions of Nepal respectively, two of which at least I have seen from the more Western Hills; *P. Bondar* (P. hirsutus, Hodg.) is confined to the Turaï; *P. nepalensis*, Hodg. frequents the middle ranges of the mountains, and *P. larvatus*, (P. lanigerus ? Hodg.) is only found in the higher regions. Two species of Mungoos (*Herpestes*) likewise inhabit the lower terraces; *H. griseus*, called Nyool in Nepal, does not extend beyond the Turaï, but *H. Edwardsii* (H. auropunctata, Hodg.)‡ ascends the central hills; whilst *Viverra Rasse* and *indica*, and *Viverra Zibetta*, are said to frequent the same localities respectively.

The true Mustelæ, a genus proper to more northern latitudes, abound in the Himalayas, where there appear to be many different species, some of which, according to Mr. Hodgson, differ but little from those of Northern Europe and Asia. It is to be remarked, however, that they have never been properly compared; but it is interesting to find this additional instance of the relation between generic forms and climate. In the central region, besides *Mustela flavigula*, Mr. Hodgson mentions two closely allied species, one larger and of a fuller habit of body, (query, Paradoxurus larvatus ?); the other, which he has described under the name of *Mustela Kathiah*, is much smaller, and often domesticated by the Nepalese for the purpose of destroying vermin, and sometimes even large animals.§ This appears to be the *Kukar* of Kemaon, where it likewise frequents the villages, burrows in the walls of houses, and is similarly protected by the inhabitants.‖ The *Mustela lanigera* of Mr. Hodgson resembles the common Weasel of Europe, but differs in its spirally twisted hair; and the same gentleman mentioned another species so nearly approaching our common Pole-cat, that he is unable to perceive any specific difference; however it will probably turn out to be distinct. Both these latter species abound in the northern and central regions. No fewer than seven species of Otters are said by Mr. Hodgson to inhabit the Himalayas; but they require to be carefully studied and compared, before we can venture to pronounce definitely upon their specific distinction. It is certain, indeed, that several species do actually exist in these Hills; Mr. Hodgson has himself given brief characters of four which he regards as new,* besides the two common species of the plains, (*Lutrae Nair* and *Leptonyx*), and seems to intimate that the seventh may be no more than a variety of the common European Otter.† The following is the substance of Mr. Hodgson's observations in the letter already referred to, and I give them at length in the hope that they may induce other observers to co-operate with that gentleman in filling up the sketch of which he has given an outline. "Of Lutræ we have seven species, five differing from the two usually found in the plains, as well as from all described species, except the common Otter (*L. vulgaris*), of which the largest Nepal species seems to be only a variety. It is five feet long, including the tail, and is the largest, though not the longest of our species. It is peculiar to the lower region, where also three other species inhabit: two more belong to the central, and one to the Kachar. One species is yellowish brown all over; the others brown, more or less dark, some having the chin and throat much paler than the rest of the body, and approaching nearly to white or yellow. They differ in length from five feet to one and a half feet; some being quite vermiform, and others as bulky as the Badger. Detailed descriptions, skulls, and skins of these animals, are much wanted."

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* Journ. Asiat. Soc., v. 232.

† Asiat. Res., xix. I. 72.

‡ Zool. Proc., i. 68.

§ Journ. As. Soc., iv. 703.

‖ Asiat. Res., xvii. 16.

Of the genus *Canis*, different species are found everywhere. The common Pariah Dog is universally dispersed through the mountains, but the Thibet Mastiff is confined to the Kachar, into which it is imported from its native country. There are many distinct varieties of this noble animal. That called *Sassa*, a large black kind, with dew claws on the hind feet, is esteemed the finest: another called *Mustang* is of a bright red colour. The common Wild Dog, called simply *Junglee Coota* in the Plains and *Buansu* in Nepal (*Canis Duckunensis* of Sykes and *C. primævas* of Hodgson) is only found in the lower regions, but is replaced farther up by two other wild species, likewise called *Junglee Coota* by English sportsmen. Lieut. Smith informs me that one of these is larger and the other smaller than the *Junglee Coota* of the Plains, from which they both differ in having shorter tails and a lighter or more ashy colour: both species ascend the Hills even to the snow line; they hunt in packs, and inhabit ravines and rocky dells; but, being excessively shy, are not very often seen. The *Junglee Coola* of the Plains, in other respects, does not appear to me to differ from the *Canis Sumatrensis* of General Hardwicke. The *Kokree*, or small Indian fox (*Canis Corsac*, *Indicus*, *Bengalensis*, *Kokree*, *&c.*); and the *Berria*, or Wolf of India (*Canis pallipes*, Sykes), never ascend the Hills. The Jackall (*Canis aureus*), is however occasionally said to be found in the central regions; but the higher mountains are inhabited by a very beautiful species of Fox, which Dr. Royle first noticed as the Hill Fox,* and of which he brought home the first skin ever seen in England, and which was described at the time in the present memoir, and afterwards in the Proceedings of the Zoological Society, Part iv. p. 108, by the name of *Canis Himalaicus*. Mr. Pearson, then Curator of the Museum of the Asiatic Society at Calcutta, likewise described it about the same time as the latter;† and as he had a few months priority in point of publication, his name of *Canis montana* must have the preference.

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* Journ. As. Soc., viii. 319.

† Letter to Zool. Soc.

The Hyæna of India (*H. Virgata*), a native of the Plains, sometimes ascends even to Simla.

RODENTIA.

The remark which was formerly made to account for our limited knowledge of the *Cheiroptera* and *Insectivora* of these mountains, may be applied with equal force to the present family; *viz.* that the comparatively diminutive size and timid habits of the animals which compose it screen them from general observation. Still we have much more detailed accounts of the Himalayan *Rodentia* than of either of the two former families, though even these are far from being so complete as could be wished.

The striped Squirrel of the Plains (*S. palmarum*) is, according to Mr. Hodgson,‡ abundant in the lower hills of Nepal; and I have seen a second species (*Sciurus Lokriah*, Hodg.) of the same size, but of a uniform earthy brown colour, tipped with golden yellow, which is said to be an inhabitant of the central regions. Mr. Hodgson mentions a third (*S. Lokroides*) similar to the latter, and perhaps not specifically distinct.§ Two beautiful species of flying Squirrel‖ (*Pteromys magnificus* and *P. alboniger*, Hodg.) are found both in the northern and central regions, but do not extend to the very elevated parts of the mountains.* Here, however, are found a small brown kind of Marmot, called *Bkia*† by the natives, hitherto undescribed; and an equally undescribed species of Rat,‡ with a tail not more than half an inch in length, most probably a Lemming (*Georychus*, Illiger), if it be not rather a *Lagomys*, of which rare and essentially arctic genus Doctor Royle has brought a beautiful specimen from the Choor Mountain. Captain Herbert, in his tour up the Valley of the Sutlej,† met with this tailless rat at an elevation of 12,000 feet, and observes that the ground was every where cut up into groves by it in search of food. He conjectures the animal to be a species of Spalax, but Dr. Royle is rather disposed to think that it was no other than the Lagomys, as he observed the ground similarly cut up in the vicinity of the spot where he obtained his specimen. The circumstance of the tail, however, which, short as it is, is expressly mentioned by both Capt. Herbert and Mr. Traill, appears to me to preclude Dr. Royle's supposition, since the Lagomys of the Himalayas, like the rest of its congeners, is absolutely without any rudiment of this organ. It is not improbable, indeed, that species of all the three genera here mentioned may be found among the more elevated ridges of the Himalayas, of which the climate is perfectly adapted to their habits: and it is to be hoped that future observers will direct their attention to the elucidation of this, as well as the numerous other unsettled points of Himalayan Mammalogy, to which I have already been so frequently obliged to refer.

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* Journ. As. Soc., i, p. 99, 1832.

† Journ. As. Soc., v. 113.

‡ Proc. Zool. Soc., ii. 98.

§ Asiat. Res., xvi. 153.

‖ Asiat. Res., xvii. 16.

Dr. Falconer, in the report of his recent journey to Cashmere and Little Thibet, mentions a Rodent under the name of the Thibet Marmot, which he says was first found in a bleak and rocky tract of country, immediately after passing to the northern slope of the great Himalayan range; but we have no farther knowledge of its characters: however, this is precisely the locality in which Mammals of this description might naturally be expected to abound. Rats and Mice, differing little, if at all, from our common European species, are abundant in all the houses. Mr. Hodgson,† indeed, expressly states that both our black and brown, or Norway rats, (*Mus Rattus* and *M. decumanus*), are the common species of Nepal, and Mr. Traill mentions them incidentally as inhabitants of the province of Kemaon. This is another interesting and important point of similarity between the Zoology of the Himalayas and that of the more northern parts of Europe and Asia; nor can we attribute the presence of these animals, in this part of the globe, to the introduction of European conquerors, as is well ascertained to have been the case in America* and Australia, since they are confined to the mountains, and altogether unknown in the Plains of India, except perhaps in some of the largest seaports. They must consequently have travelled south to reach their present habitat; and, no doubt, exist in Thibet, Tartary, and other intermediate countries, where the climate is suitable, as far as Northern Asia, from which at least one of the species (*M. decumanus*) is said to have been originally introduced into Europe. Besides these, Mr. Hodgson describes two other species (*Mus niviventur* and *M. nemorivagus*) as peculiar to the Himalayas; and I have received a Rat from Dr. Royle, which in the dried state of the specimen I cannot distinguish from the common European Campagnol (*Arvicola vulgaris*), a fact the more interesting from this genus being confined to the temperate and colder regions of the Old World. The *Bandicoot*, or great Rat of the Plains (*M. giganteus*) does not exist in Nepal;† but various kinds of Field Mice, of what precise species is not mentioned, are stated to be sufficiently common.‡ The Porcupine (*Hystrix cristata var. leucarus*, Sykes) is found in Kemaon,§ and the lower and central regions of Nepal.||

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* Journ. As. Soc., v. 232.

† Asiat. Res., xv. 5.

‡ Proc. Zool. Soc., ii. 98.

Mr. Hodgson¶ mentions two species of Hares as inhabiting Nepal. One he calls the common small species (probably the black-necked Hare of F. Cuvier, '*Lepus nigricollis*'), which, he says, is confined to the Turaï; the other, which he considers a new species, as large as the common English Hare and nearly resembling it, inhabits the higher and colder parts of the mountains. This is *probably* the red-tailed Hare of M. Isidore Geoffroy St. Hilaire,** (*L. ruficaudatus*), of which Dr. Royle obtained a specimen at Hurdwar (?) and which, he informs me, is very common in the Doon and in the neighbourhood of Delhi. As M. Is. Geoffroy's short description of this species is necessarily imperfect, from the mutilated state of the only skin which he had an opportunity of examining, the following more detailed account will not be unacceptable to the scientific Zoologist:—

The skin obtained by Dr. Royle is that of a full-grown female; it is in perfect condition, and measures one foot ten inches from the nose to the origin of the tail: the ears are about five inches in length, and the tail four inches. The face, back and sides are regularly brindled, or varie-

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* Proc. Zool, Soc., ii. 98.

† Asiat. Res., xvi. 153.

‡ Richardson Faun. Bor. Amer., i. 140-1.

§ Journ. Asiat. Soc., v. 234.

|| Proc. Zool. Soc., ii. 97, 98.

¶ Traill in Asiat. Res., xvi. 153.

** Dict. Class., ix. 381.

gated with alternate wavy lines of black and light sandy brown, arising from the hairs on those parts being annulated with these two colours. The whole coat is short, smooth and glossy; it consists of a short fine internal fur, of a cottony texture, and pale bluish white colour, and of a long, coarse, external hair, which, as just observed, is annulated with black and light sandy brown, and gives the general colour to the upper parts of the body. In the distribution of these colours, each hair is divided into three equal parts, the top and bottom being black, and the centre light reddish brown. The dark colour predominates most on the face, hips, and along the median line of the back, but becomes gradually fainter upon the shoulders and flanks, and is separated from the pure white of the belly by a narrow band of pale rufous. The cheeks are grey, pointed or intermixed with black; a light grey spot occupies the space in front of each eye; the chin is also grey, and the moustaches long and stiff, black at the roots and grey at the points. The ears *appear* to be reddish brown tipped with black, but the hair has been partly rubbed off in the specimen described, which prevents me from speaking with certainty. The whole upper part of the neck is pure unmixed sandy red, the fur being of the same quality as the internal fur upon other parts of the body, and without any intermixture of the long external silky hairs. The outer face of the arms, the whole of the fore legs, and the outer face of the hind, are also red; the tail red, or rather reddish brown above, and pure white beneath; and the belly and under parts of the body unmixed white. The animal had probably been killed whilst suckling her young, as the skin exhibited four very large teats, one pair on the breast and the other on the abdomen. These were all I could observe, but there may have been more, as the skin had been a good deal rubbed about these parts.

But by far the most interesting and unexpected acquisition, which Dr. Royle's discoveries among the Himalayas has produced to the Zoologist, is a new and beautiful species of *Lagomys*, a genus heretofore only found in Northern Asia and among the rocky mountains in North America. This discovery, of the greatest importance to our inquiries into the principles which regulate the geographical distribution of animals, is entirely due to Dr. Royle, and furnishes another, and a most glaring instance of the paramount influence of climate upon the dispersion of animals, as well as vegetables. Unfortunately, the only skin which Dr. Royle has brought to England, is too imperfect to admit of so detailed a description as would be desirable. The skull has been taken out, (it is now in the Museum of University College, and, Professor Grant informs me, exhibits the same form of dentition as the other species of Lagomys described by Drs. Pallas and Richardson), and the hind legs cut off, but in other respects it is in a sufficiently good state of preservation to enable me to assign its specific characters. I propose, under the specific denomination of *Lagomys Roylii*, to dedicate it to my friend Dr. Royle, in commemoration of the important service which that distinguished Botanist has rendered by its discovery to the kindred science of Zoology.

The *L. Roylii* more nearly resembles the *Sulgan* (*L. pusillus*, Pallas), and the American species (*L. princeps*, Richardson), than either the *Pica* or *Ogotona* (*L. alpinus* and *Ogotona* of Pallas). With the exception of the *Pica*, however, it is considerably larger than any other species of *Lagomys*: the skin here described, notwithstanding its imperfect state—for the hinder parts have been partially mutilated, measuring eight and a half inches in length, which is more than one-third as large again as the *Ogotona*, *Sulgan* or American species. From the *Ogotona*, however, it is easily distinguished by its colours, which, in that species, are light grey above and pure white beneath, as well as by its naked soles. The triangular form of the ears in *L. pusillus*, prevents that animal from being confounded with any other species, and the *Pica* (*L. alpinus*), which alone approaches the size of *L. Roylii*, is at once distinguished by the sandy red colour of its fur. The *L. princeps* of Dr. Richardson is the only remaining species of the genus at present known; it is very similar to our animal in the colour and quality of the fur, but may be readily distinguished by its inferior size, and by the deep black hair which covers the external surface of its ears, and which is replaced in *L. Roylii* by long fur of a pure white colour.

The fur of this species is of two kinds, a very soft and fine internal one of a beautiful blue black over every part of the head and body, as well above as below, and a coarser external kind, of the same colour at the base, but afterwards marked with a broad ring of a greyish yellow colour, and finally tipped with dark brown. These two kinds of fur, however, are not produced by an actual difference in the individual hairs; on the contrary, the same hairs exhibit both the appearances here described, being extremely soft and fine at the root, and assuming a harsh and rigid structure towards the extremity. These harsh tips, being the only parts of the fur seen from without, give their general colour to the whole body. On the upper parts of the body, the head, back and sides, this is uniform brown, slightly mixed with yellowish grey, very dark on the back, much more so, for instance, than in the common Rat (*M. Decumanus*), but rather paler on the sides, and yellowish white on the belly; the hairs on this part wanting the harsh brown point, though in other respects perfectly similar to those of the back. The fur on the body is about an inch in length, and nearly as long on the head, which gives the face a rough shaggy appearance. The nose is entirely covered with short harsh hair of a uniform brown colour; the upper lip is bilobed as in the Hare; the ears are of an elliptical form with regularly rounded tops, covered internally with very short brown hair, and on the outside with long white hair at the base, and short brown at the top, the posterior edges having a scarcely perceptible narrow white border. They are about half an inch broad and three quarters of an inch in length, with a small internal lobe about a quarter of an inch long, and have the folding inwards of the anterior margin, and, consequently, the resulting funnel shape of their basal portions, which Pallas noticed in the species of Northern Asia. Dr. Richardson could observe nothing of this appearance in his *L. princeps*, but I presume this must have arisen from the imperfect state of his specimens in a part so liable to be injured, since an individual in the British Museum exhibits the structure too obviously to have otherwise escaped the notice of that accurate Zoologist. The vibrissæ of *L. Roylii* are nearly as long as the head and ears together, and of a uniform brown colour. The arms and fore-arms, and, I presume, the thighs and legs, for, as I have already observed, the posterior members are wanting in the specimen, are covered with fur of the same colour and quality as that on the body, only shorter; but the whole upper face of the carpus, and probably also of the tarsus, is covered with short adpressed hair of a bright reddish yellow colour. The soles of the fore feet present four naked tubercles, corresponding to the extremities of the toes, and a fifth, considerably farther back, which represents the heel, and is separated from the others by a space covered with very short brown hair. The thumb is situated behind the other toes, and, like them, has a small sharp claw of a dusky horn colour.

Dr. Royle obtained his specimen on the Choor Mountain. I take it to be this animal which Captain Mundy* met with during his interesting tour recently published, and which he describes as something between a hare and a guinea-pig; and it is probably, also, the tailless rat which Turner† observed in Thibet, where the banks of a lake were everywhere perforated by its burrows.‡

* Tour in India, II., 196.

† Journey to Thibet, 211.

‡ I have since seen perfect specimens of this animal, but have nothing to add to the description here given.

EDENTATA.

Of this family, the only species known to inhabit the Continent of Asia, the short-tailed Manis, or Scaly Anteater of authors (*Manis pentadactyla* of Linnæus, *M. macroura* of Desmarest) is found in the lower and less elevated parts of the central regions: but all the *Edentata* are essentially inhabitants of the warmer parts of the earth, more especially of tropical America, and we cannot therefore expect to find their forms reproduced in the Himalayas. Mr. Hodgson has described the Manis of Nepal as a new species, under the name of *M. auritus*,* on the supposition of its being distinct from the common species of the plains of Upper India, the *Badjarkita* of the Bengalese (*M. macroura*), which has been known ever since the expedition of Alexander the Great, and is mentioned by Ælian under the name of Φατταγης; but Mr. Hodgson in this, as in many other instances, has been misled by Griffith's Translation of the *Regne Animal*, a compilation which has obtained a much greater authority in India than its merits entitle it to, or than it enjoys at home.

PACHYDERMATA.

The great Saul Forest, which extends for many hundred miles along the bases of the Himalayan Mountains, affords shelter to vast multitudes of animals, of which it is probable that many species still remain undescribed. Among other genera, the large *Pachydermata* abound in these situations; the Elephant and Rhinoceros (*Elephas indicus* and *Rhinoceros unicornis*), are extremely numerous; and in the rainy season, or in times of scarcity, make frequent inroads into the lower hills, and commit great depredations among the crops of the natives. The Indian Rhinoceros affords a remarkable instance of the obstructions which the progress of knowledge may suffer, and the gross absurdities which not unfrequently result from the wrong application of a name. This animal, to whose horn the superstition of the Persians and Arabs has in all ages attributed peculiar virtues, became known to the Greeks through the description of Ctesias, a credulous physician of that nation, who appears to have resided at the court of Persia in the time of the younger Cyrus, about 400 years before the birth of Christ. His account, though mixed up with a great deal of credulous absurdity, contains a very tolerable and perfectly recognizable description of the Rhinoceros, under the ridiculous name, however, of the *Indian Ass*; and as he attributed to it a whole hoof, like the horse, and a single horn in the forehead, speculation required but one step further to produce the fabulous Unicorn, such as it appears in the royal arms of England, and such as it has retained its hold on popular credulity for the last two thousand years. The works of Ctesias have perished, but this curious passage is preserved by Phocius;[*] Aristotle[†] adopted his statements regarding the *Indian Ass*, from Ctesias; and no other passage of his writings has given rise to a tenth part of the commentaries, discussions, and speculations which have originated in this. Religion was, as usual, pressed into the discussion, and as the Septuagint had used the word *Monoceros*, it was at one time next to rank heresy to doubt the existence of the Unicorn, and might have brought the imprudent sceptic to the stake. But it is not my intention to renew this fruitless and childish discussion; my only wish is to point out the perfect applicability of Ctesias's description to the Indian Rhinoceros, as it is now well known to naturalists; those who wish to pursue a subject of considerable interest in the history of human knowledge, will find many curious details in the writings of the learned Bochart,[‡] in Scaliger, Hardouin, Sivry, and others of the older commentators on Aristotle and Pliny.

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* Journ. As. Soc., V. 234.

Wild Hogs, but of a smaller variety than those of Bengal, are extremely numerous in all the wooded parts of the mountains; they do not appear to be specifically different from the common wild boar of Europe. Horses do not breed on the southern face of the mountains, but are imported from Thibet.[§] A valuable and sure-footed variety, called Tangun, is described by Turner.[||] The Ass does not appear to have been introduced into any part of the mountains, at least neither Dr. Hamilton nor Mr. Hodgson makes any allusion to its being found in Nepal,[¶] and Mr. Traill expressly states that it does not exist in Kemaon.[**] The Dziggetai, however (*Equus hemionus*), is found on the plains of Thibet and Tartary, and is called *Kiang* by the natives.

RUMINANTIA.

The Ruminantia of the Himalayas, as composed of the larger four-footed game most commonly followed by sportsmen, are probably better known than any other department of Hill Mammalogy. Yet even here much still remains to be done to make us thoroughly acquainted with all the different species or varieties which have been mentioned by Mr. Hodgson* and other writers; the nomenclature, in particular, is extremely confused, and there is strong reason to believe that the number of species, particularly among the deer tribe, has been greatly increased by the variety of names given to the same animal in the ever varying dialects of the hill tribes. I have, however, only mentioned those of which the existence is known with some degree of certainty.

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[*] Photii Biblioth. cod., 72, p. 91.

[†] Hist., lib. ii., c. 1.

[‡] Hierozoï, lib. iii., c. 26.

[§] Mundy's Tour. ii., 75.

[||] Fraser's Journey, p. 351.

[¶] Hamilton's Nepaul, 79.

[**] Journey, 21.

The Musk (*Moschus moschiferus*), called Kastooree, is not uncommon in the higher hills. It is said to derive its peculiar odoriferous secretion from feeding on the Kastooree plant, a kind of ground nut, which is strongly impregnated with the same pungent scent, and which the animal digs up with its long tusk. Mr. Hodgson, in a recent number of the Journal of the Asiatic Society,† expresses his belief in the existence of three different species of this animal among the Himalayas, and even assigns them distinct names; but the characters are founded entirely on the difference of colour, which is too variable to be depended on for the purpose of specific distinction; and, in fact, Lieut. Smith assures me that the colours vary with the age of the animal; a remark on which I am disposed to place the greater reliance from its agreeing with my own observations, made on many individuals preserved in the museums of this country and the Continent. Whether the "Second species of Musk," mentioned by Dr. Falconer as having been discovered during his recent journey into Cashmere and Little Thibet, be founded on more important characters, we have no means of ascertaining, that Naturalist not having yet published his observations.

Of the genus Cervus, the Chittra or Spotted Axis (*C. axis*), and the Laguna or Pâra and Sûgoriah, called also *Jhou Laghuna* and *Khar Laguna*, or spotted and brown varieties of the Hog-deer (*C. porcinus*) are common in the lower hills and forests, but do not ascend the mountains. The specific distinction or identity of the two latter animals has long been a subject of dispute among naturalists; Lieut. Smith believes that the spotted variety is only the young; but I have myself seen animals at least three or four years old, with a row of spots on each side of the spine, though, at the same time, I do not believe them to be distinct from the plain coloured or common brown variety, with which they perfectly agreed in every other respect. The subject is worth the attention of those who have an opportunity of settling the question. Three other species of the Axine group of deer are mentioned by Mr. Hodgson, under the collective name of Jaraï, but individually distinguished by the Nepalese as the Phûsro, Râto, and Kâlo, or hoary, red, and black Jaraïs respectively. The two former have been identified with the *Cervus Hippelaphus* and *Cervus equinus* of Cuvier, the latter certainly without foundation, and the former at least very doubtful; the third, said to be undescribed, is probably the *C. Aristotelis* of Cuvier; but the truth is, that we know very little about them, nor are these different species mentioned by any other author besides Mr. Hodgson. The *Cervus Hippelaphus*, indeed, called *Saumer* or *Sambre* in the Plains, is well known in this country, where he has long existed in our menageries, and is probably the *C. Aristotelis*, which is familiarly called *Elk* in the Hills, and of which the native name in the British hill provinces is *Jerow* for the male, and *Maha* for the female, names which have been not unfrequently applied to different species; of the Phûsro, or Hoary Jarai of Mr. Hodgson, which, whatever else it may be, is certainly not the *C. equinus*, since that species does not inhabit Continental India, nothing is known but the name, if, indeed, it be not a mere variety of sex or age. Lieut. Smith describes the Jerow of the Hills as a larger and heavier animal, and with finer horns, than the Saumer of the Plains: the tan and black colours of these two species appears to identify them with the Râto and Kâlo Jaraïs of Mr. Hodgson.

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* Asiat. Res., xvi., 351.

† New Series, I., 202.

No fewer than three species of deer, with characters approaching to those of the common stag (*C. Elaphus*) of Europe, have been mentioned as inhabitants of Nepal. Two of these, the *Cervus Wallichii* and *Cervus Duvaucellii* of Cuvier, are known, though not so perfectly as could be wished; the third, which has been identified with the common stag, appears to be founded upon error. Mr. Hodgson has briefly described the *Cervus Duvaucellii* under the name of *C. Elaphoïdes*, and I have seen a full-grown male in the Zoological Gardens; the comparison of the skull figured by Mr. Hodgson* with the horns in the *Ossemens Fossiles* leaves no doubt as to the identity of the species. It is called in Nepal *Baraïyo*, and, according to Mr. Hodgson, *Maha* in the Western Hills, a name which, as observed above, Lieut. Smith applies to the female Jerow. *Cervus Wallichii*, called *Barah Singha*, is mentioned by Mr. Walter† as an inhabitant of the mountains of Silhet, and by Mr. Hodgson,‡ who confounds it with the common stag, as found in the Saul Forest, which skirts the foot of the Nepal Mountains, whence it was originally sent to Calcutta by Dr. Wallich. There is no grounds for supposing the existence of a third species of this group in the Himalayas, identical with the Red Deer of Europe (*C. Elaphus*), though the fact is distinctly stated both by Duvaucel and Mr. Hodgson :* these authors appear to have mistaken the *C. Wallichii* for that animal, though the specific distinction was afterwards well known to Duvaucel, who sent to Baron Cuvier the description published in the "Ossemens Fossiles." Dr. Falconer mentions the discovery of a new species of deer in the Report of his recent Journey to Cashmere and Little Thibet,† and Dr. Royle has figured (tab. 5, fig. 1) a female under the name of *C. Dodur*, by which it is known about Saharunpore. He describes it as being about the size of the female Hirn (*Antilope cervicapra*), lighter and more graceful than the Hog-deer, and of an ashy brown colour; but this is all I know of the animal, nor do I find it even mentioned by any other writer. It appears to be unquestionably a new species, and is well worth the attention of Indian naturalists.

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* Journ. Roy. As. Soc., IV., 648. † Asiat. Res., xvii., 499. ‡ Loc. Cit.

Of the *Muntjac* tribe of deer, I am acquainted with three distinct species inhabiting the Indian continent: one entirely black (*C. melas*), one of a light sandy fawn colour, probably the *Ratwa* of the Nepalese (*C. ratwa*, Hodg.), and the third the common Muntjac, called Kacker by the natives, and Barking Deer by the Europeans (*C. Muntjac*, Lin.), of a deeper bay and much smaller size than the *Ratwa :* the former is scarcely the size of the Roe-buck (*C. Capreolus*); the latter nearly equals the Fallow Deer (*C. Dama*, Lin.). Dr. Royle has figured the "Barking Deer" of the North Western Himalayas, v. tab. 5, fig. 2, under the name of *Cervus Rutwa*, conceiving it to be identical with Mr. Hodgson's species. All these animals may be readily distinguished from the other species of Deer, by their long projecting tusks, horns mounted upon long bony pedicles, and the glandular folds of skin on the forehead. They require, however, to be more attentively examined, and compared with one another.

Of *Hollow-horned* Ruminants, the *Ghoral* and *Thar* (*Antilope Ghoral* and *A. Thar*), are now pretty well known from the researches of Mr. Hodgson, who has set a praiseworthy example to our Indian countrymen, by the laudable zeal with which he perseveres in illustrating the Zoology of Nepal. Both these species are proper to the middle and northern regions of the Hills. The Thar of Mr. Hodgson is universally called *Surow* and *Imoo* in the more western parts of the mountains, the latter name predominating in the higher, and the former, in the lower hills : the name of Thar, according to Lieut. Smith, is there applied exclusively to the species of goat which Mr. Hodgson calls the *Jharal.* That beautiful and stately antelope, the *Chiru* (*A. Hodgsonii*), of which our knowledge is entirely due to Mr. Hodgson's researches, is confined to Bhot, Thibet, and the surrounding countries; it appears to be altogether unknown on the southern face of the Mountains, except from an occasional specimen imported by the traders, either for presents or barter. The common Indian antelope, called *Hirn*, and the *Chickarra*, or four-horned species (*A. cervicapra* and *quadricornis*), are confined to the lower hills and forests, and the *Neel-ghau* (*A. picta*) principally to the plains and jungles of the north-western districts. Mr. Colebrooke says that, in the opinion of the Hindoos, the resort of the Antelope sanctfiies the countries graced by his presence, while his absence degrades the regions which he avoids. This seems more connected with physical observation than with popular prejudice. The wide and open range in which the Antelope delights is equally denied by the forests of the mountain and by the inundation of the fens.* These are the only antelopes of which we have any precise knowledge, as inhabitants of this part of India; but it is probable that others still remain undescribed. Captain Herbert,† in his "Tour to the Sutlej," mentions two animals by the names of *Skin* and *War*, the accounts of which do not agree with any known species, and which are therefore well worth the attention of future observers. The *War*, according to Capt. Herbert, is somewhat like the *Musk Deer* (*Moschus Moschiferus*), but with a face more like that of a sheep, divided hoofs, and horns more nearly resembling those of a buffalo than of any other animal; a description which, in spite of the similarity of names, is inapplicable either to the Thar or Jharal, though indeed, little dependence is to be placed in the descriptions of unscientific observers.

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* Asiat. Reg., xv., 120.

† Journ. Asiat. Soc., iv., 710.

The *Neel-ghau* deserves a more particular notice, for the purpose of clearing up a point in its history, equally interesting to the Classical Scholar and to the Zoologist. It has been already observed that Modern Naturalists, after the example of Baron Cuvier, have identified the great *Saumer Deer* of India with the animal which Aristotle describes by the name of *Hippelaphus*. "The *Hippelaphus*," says the Greek philosopher,‡ "has also a mane, (he is talking of the mane of the Horse), above the shoulders, but from this to the head along the top of the neck *it is very thin*; it has likewise a *beard on the larynx*;......it is about the size of the Stag......the female has no horns......those of the male resemble the horns of the *Dorcas* (*A. Gazelle*)......it inhabits Arachosia."

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* Colebrooke on Bengal Husbandry. † Asiat. Res., xv., 397.

‡ Hist. lib. II. c. 5.

Any one acquainted with the *Neel-ghau* will readily perceive the applicability of this passage to its most obvious characters: in fact Aristotle's description of this animal, under the name of *Hippelaphus*, is more exact and minute than the description of any other animal mentioned in his history; it is evidently taken from personal observation, and it is surprising that the application should have hitherto escaped the penetration both of critics and Zoologists. The older naturalists, such as Gesner and Aldrovandus may be excused for misapplying the passage in question, sometimes to the Elk, sometimes to the common Stag in his winter-dress, when the hair of the neck becomes longer than ordinary, since they were unacquainted with the form and characters of the *Neel-ghau;* but the continuation of the mistake by their successors, to whom the animal has been long familiar, is altogether unpardonable. This identification, indeed, was absurd enough from the beginning: the habitat of Arachosia, and the assigned form of the horns, were alone sufficient to distinguish the Hippelaphus from either the Elk or common Stag, independently of the critical absurdity of supposing Aristotle to describe such well-known animals at such length and under a new name: but the truth is, that all modern commentators have been misled by a wrong translation of the term Δορκας, employed by Aristotle, as the name of an animal, to the horns of which he compares those of the Hippelaphus. Now, it is to be observed that the Dorcas of the Greeks and Romans is universally admitted to be the Gazelle of Egypt and Northern Africa, as may be easily proved from many passages in Herodotus and other ancient writers. Theodore Gaza, himself a Greek, and the first translator of Aristotle, very properly renders the word by *capra*, but Buffon* having criticised Gaza's *ignorance*, and affirmed that the word should really be translated *caprea*, every body has since followed the translation of Buffon, and the *Dorcas* of Aristotle has been accordingly considered identical with the *Roe-buck*, whilst the *Dorcas* of all other ancient writers is acknowledged to be the *Gazelle*.

This seems to have been one of the principal sources of error which misled Baron Cuvier, after the example of his predecessors, to identify the Hippelaphus of Aristotle with a species of Deer. The head and skin of the large Indian *Saumer* had been sent to Paris by Diard and Duvaucel; the hair of the neck was observed to be considerably longer and coarser than that on the rest of the body, the horns had only two antlers, *like those of the Roe-buck*, and it came from India. Baron Cuvier immediately concluded that he had discovered the real Hippelaphus of

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* Hist. Nat. XI. 402.

Aristotle, and takes considerable pains to prove it.* Against this opinion of the most distinguished of modern naturalists, however, I have to urge objections as grave as those which lay against the ancient error which identified the *Hippelaphus* with the Stag and Elk. In the first place, as I have just shown, the fancied similarity of the horns of the *Hippelaphus* to those of the Roe-buck, arises from a false translation of the word *Dorcas;* when this term is properly translated, *Gazelle*, the horns of the *Hippelaphus*, to be similar to those of the *Dorcas*, should be small, round, and *without branches;*—such are the horns of *Neel-ghau*, and such are not the horns of the Saumer. In the second place, the *Saumer* Deer has certainly longer and stiffer hair on the neck than elsewhere, but it is equally long and rough *over the whole neck, as well on the sides as above and below*, and has no resemblance whatever to the mane of the Horse and Mule to which Aristotle compares it. In fact the description of Aristotle does not apply to it in any particular. *The Saumer* does not show the least appearance of the *thin mane along the top of the neck, longest and thickest on the shoulders;* neither has it anything that can be called a beard, distinct, at least from the general roughness of the neck which Baron Cuvier calls its mane. But even allowing the rough hair on the under surface to be called a beard, still Aristotle's description does not apply, for this rough hair covers the *whole throat* in the Saumer from the head to the chest, whilst the Greek philosopher restricts the beard of the *Hippelaphus* to the *Larynx*, and this is precisely the situation in which the long bunch of coarse hair, nearly a foot in length, is found on the throat of the *Neel-ghau.* In fact there is not a single point, even to the most minute particular, the habitat of Arachosia, for instance, the modern Punjab, where the Neel-ghau is extremely abundant, and where the Saumer does not exist, at least we have no evidence of the fact,—in which Aristotle's description of the Hippelaphus does not perfectly agree with this now well-known animal; and we may therefore safely conclude that we have at length finally settled a question which has long puzzled both critics and Zoologists. The *Neel-ghau* should consequently assume in future the specific appellation of *Antilope Hippelaphus*, whilst the Saumer Deer, to which that name has been erroneously applied, may be more appropriately called *Cervus Saumer.*

Two distinct species of the genus Capra occur in the Himalayas: *Capra jemblaïca* of Hamilton Smith, called *Jharal* in Nepal, and *Thar* in the British provinces, is by far the more common of the two, and is stated by Mr. Hodgson* to differ from other goats by having four teats. The second species has never been described, but its existence is placed beyond a doubt; Major Kennedy, while resident at Simla, had two stuffed specimens, procured in the neighbouring mountains, and the animal is mentioned by various tourists under the name of the Ibex, which it appears to resemble in the form of the horns and other characters. Dr. Falconer, in the Report of his late Journey to Cashmere and Little Thibet, mentions the discovery of two new species of goats; but as he does not enter into any detail on the subject, we have no means of ascertaining how far they may prove to be identical with, or different from, the two species here mentioned. Different varieties of the domestic goat, the most valuable of which are the *Changra*, or shawl goats, of two breeds, distinguished as the larger and the smaller Changra, are found in the more alpine regions; their wool forms an article of extensive traffic, but we are much in want of detailed comparative descriptions and good figures of these, as of all the different breeds of cattle and other domestic animals in India; a subject of great interest, which has been extensively illustrated at home, but which has met with little or no attention out of Europe.

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* Oss. Foss. IV. 42.

Of sheep there are likewise two wild species, and numerous domestic varieties, found in these mountains. The *Burrhal*, called *Nahoor* by the Nepalese (*Ovis Nahoor* of Mr. Hodgson), is intermediate in character between the Mouflon (*O. Musmon*) of Corsica, the supposed parent of our domestic sheep, and the Aoudad (*O. tragelaphus*) of Northern Africa, which latter species it resembles in the form of the horns and the absence of the crumens, or tear-pits, which distinguish the rest of the genus. The second species, called *Banbhera* in Nepal, is less known, but appears to approach very nearly to the Argali of Siberia (*O. Ammon*), if, indeed, it be not identical with that animal. I have seen the skull and horns in the Museum of the Royal Asiatic Society, to which it was presented by Sir Alexander Burnes; but as there is no specimen of the Argali in this country with which to compare it, I can offer no opinion as to its specific difference. The animal seems to be more properly a native of Thibet and Chinese Tartary, and seldom appears on the southern part of the Himalayas; at least none of my sporting acquaintances ever met with it, and Mr. Hodgson was long doubtful of its existence. Of the domestic sheep of the Hills, besides the Dûmba, or common variety of Upper India, Mr. Hodgson mentions a breed called *Barwal* as occurring in the Kachar, and another called *Hoaniah*, peculiar to Thibet: these are used as beasts of burden for carrying grain and other products across the mountains, but we know little of their peculiar forms or qualities.

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* Journ. Asiat. Soc., iv. 710.

Of the genus *Bos*, the buffalo (*B. Bubalus*), and its representative, the *Arnee*, or *Urnee Bhinse*, are confined to the sultry forests at the foot of the mountains. The latter is a very distinct variety, if not a different species, from the *Junglee Bhinse* of Bengal and Assam, so well known for the great length of its horns; the *Arnee* of the Saul forest is the short thick horned variety, of which there are many skulls, preserved in our Museums, and is said to be a much lighter made animal, though with a thicker skin than the *Junglee Bhinse*. The Zebu (*Bos indicus*) is common in every part of the Hills; but the peculiar and appropriate species of the Himalayas is the Changree, or Yak (*Bos pæphagus*, Pallas), which composes the domestic cattle of Tartary, and is not uncommon on the southern slopes of the higher Mountains, where a cross between it and the Zebu, or common Indian Ox, is much used in agriculture, and preferred to either of the pure races. This hybrid is not uncommon at Simla, and it is to be hoped that some intelligent observer will take advantage of this circumstance to ascertain from actual experiments whether the sexes be productive *inter se*, or when united with one of the pure races; or whether, like the common mule, they be absolutely barren. Lieut. Smith informs me that he has seen the Yak wild on the confines of Chinese Tartary.—*Royle's Illustrations of the Botany, &c. of the Himalayan Mountains, Supplementary Part.*

ART. X.—*Beryl Mine of Puddioor, and Geognostic Position of this Gem, in Coimbatoor, Southern India.*—*By* Lieut. NEWBOLD, *Madras Army*, A. D. C. *to* Brigadier-General WILSON, C.B.

The Beryl mine of Paddioor, or Patialey as it is sometimes termed, is situated at the eastern extremity of a village of the same name, in the Kanghyum Taluk, in the Coimbatoor Collectorate, about forty miles E.N.E. from the town of Coimbatoor, which lies in Lat. 11° N., and Long. 77° 1′ E. The surrounding country is an undulating plain, studded with a few short clusters of hills, principally of gneiss and quartz rock. The surface of the plain is intersected by a few ravines and rivulets, flowing towards the Noel river, which, rising in the Nilgherry Chain, pursues an easterly course to the Cauvery. The latter river flows through the midst of this great plain, which is bounded by the Nilgherries to the west, and the Shevaroy and Salem Mountains to the east. All these ranges consist of normal rocks, principally gneiss, hornblende-slate, and mica-slate, associated with granite, greenstone, and basalt in dykes. The rocks that occur in the plain are of a similar description, with beds of quartz distinctly stratified, sometimes highly ferruginous, and passing into garnet rock. Garnets, regularly crystallized, often occur in the gneiss and hornblende slate. Primitive crystalline limestone and a talcose rock occur, though rarely, interstratified with the gneiss and hornblende slate. A remarkable feature is the prevalence of basaltic dykes, accompanied by large travertine and tufa-like deposits of carbonate of lime. The influence exerted by these dykes over crystalline and metalliferous developments in these districts is interesting and instructive. Dykes, or veins, of a porphyritic granite too, traverse the gneiss in various directions. The larger veins are generally from W. to E., varying a few degrees to the S. of E. The metallic ores and minerals found associated with these rocks are chiefly the magnetic or black iron ore, disseminated and interstratified with quartz rock in a state of great purity. It sometimes occurs in octahedral crystals, with a whitish micaceous looking *enduit*. Both varieties are often highly magnetic with polarity. Manganese also occurs in the form of the black oxide; also garnets, corundum, magnesite, nephrite, asbestus, chromate of iron, adularia, pyrites, &c. Rubies have been found associated with the corundum which occurs imbedded in gneiss. I am not aware that the other beautiful variety of rhomboidal corundum, viz. the sapphire, has ever been discovered; but, from certain indications, I should be led to suppose its existence. Gold-dust is found in many of the rivulets flowing down the sides of the Nilgherry and Salem Mountains.

I will now proceed to describe the bed, and minerals with which the Beryl is more immediately associated in the particular locality which has already been adverted to, viz. Paddioor. The mine has been sunk through a bed or dyke in the gneiss and mica-slate on the line of contact; it is about eighteen paces long, by fourteen broad; it has about seven feet of water covering the lower part, and is about twenty-four deep to the surface of the water. The dyke is composed of a highly crystalline porphyritic granite, the component minerals of which are generally beautifully characteristic and distinct. The quartz is sometimes regularly crystallized, but usually in amorphous translucent masses, imbedded in large tabular crystals of pale rose-coloured felspar, with cleavlandite, garnet, and white, black, and bottle-green mica. A crystallized pyramidal prism of quartz that had been dug out of this mine measured 2 feet 3½ inches in length, and 1 foot 3 inches in diameter; it had, however, been fractured, and four only of the sides were tolerably perfect. The mica occurred both in six-sided tables and in large irregularly-shaped nests, one of which measured 2 feet in length; the laminæ highly elastic and transparent. A few of the garnets were crystallized in dodecahedrons, sparingly disseminated in the rock; one of these crystals measured 2 inches in diameter. The crystals of cleavlandite were remarkably fine, and characteristic of this beautiful variety of felspar. The various minerals composing this bed pass from the porphyritic structure into a curiously fibrous arrangement: the quartz, felspar, and cleavlandite occurring in alternate prismatic laminæ; sections of this rock, at right angles with the long axis of the prisms, exhibit on their surfaces the appearance of graphic granite. Where this arrangement is observed, the mica is partially and irregularly distributed in thin pyramidal nests, rarely in direction with the laminæ of the rock. The quartz and felspar, where they meet with a large nest of mica, usually lose their laminar structure, becoming confused and lumpy. The felspar and cleavlandite is both white and translucent, and opaque and reddish; the latter is often crossed by microscopic fissures, inclined at a great angle to the axis of the prism. Ghunpore, in the Nizam's dominions, is the only other locality in India where I have met with this fibrous rock; it was there also associated with gneiss and granite. The cleavlandite often occur in large masses, with small cavities partly formed by the decomposition of the rock, and partly by the intersection of the longer and more distinct crystals of the cleavlandite; it is in this gangue, and in these cavities, that the Beryl, or aquamarine, is almost invariably found, in long deeply striated hexahedral prisms, with small crystals of quartz.

The whole of the rock, composing the dyke, is divided by seams, almost horizontal, intersected by fissures, thus dividing it into cuboidal masses. Many of the seams are filled by a whitish earthy incrustation of carbonate of lime, that has a tendency to collect in nodules. The larger calcareous veins attenuate as they ascend in the rock, and appear to have penetrated it from below, rather than to have been deposited from above. On reaching the surface, which it often overspreads, in beds of great extent, underlying the present soil, it assumes a closer texture, with a nodular or pisiform surface, the interior having a spheroidal structure, not unfrequently assimilating that of the travertine of San Filippo. It has been deposited, no doubt, by springs of water ascending through the subjacent strata, charged with carbonic acid, and holding lime in solution.

Small springs are still observed percolating upwards through the fissures of the rock; and, as they trickle over its surface, depositing a thin black crust composed of carbon, a little iron, calcareous and saline matter; the latter contained both the muriate and sulphate of soda; which salts, and nitrate of potass exist abundantly in the soil of the adjacent district. The water at the bottom of the mine is sufficiently pure for irrigation and the purposes of life.

There are marks of other excavations in this vicinity, and in the same bed. The natives, however, assert their perfect ignorance of their use. Judging from the high barren situation in which I found them, these excavations could hardly have been made for wells. Blocks of the cleavlandite, which forms the matrix of the gem, had been thrown out, and evidently broken up in search of what it might be supposed to contain. The excavations were shallow, but extensive, and the quantity of the broken up gangue very large; it (the cleavlandite) can be traced in the rocks in the vicinity to an extent, east and west, of about thirty-eight miles; and it is likely that, in ancient times, antecedent to Mahomedan conquest, when rights to landed property were more secure, the gem was obtained in abundance. Now, the surface veins appear to be completely exhausted in all the excavations I examined; but it is probable, from the inquiries I made, that it is still secretly procured by natives from certain localities in this district, as it still forms an article of traffic in Indian bazaars. It has been thought, with some reason, that the largest crystallized Beryl ever known, weighing six ounces, and costing £500, and which was supposed to have been brought to Europe from Ceylon, was the produce of the Beryl mines of Coimbatoor, as neither Davy, nor any of the authors conversant with the mineralogy of Ceylon, mention its existence on that island. It has been stated positively that it does not occur there.

To Mr. Heath the merit is due of having first brought these mines under the notice of government. Mr. Fischer, the enterprising land-proprietor of Salem, informed me that the gem was first discovered by the diggers of a well on the estate of the village Potail, who sold them secretly to the itinerant jewellers and chittys, who purchased them in large quantities for a mere trifle, and sold them at an immense profit at Madras, Pondicherry, and other European settlements. This, coming to Mr. Heath's knowledge, afforded a clue by which he was enabled to trace the beryl to its situs. He lost no time in obtaining the conditional consent of government, and arranging with the native owner of the land. Mining operations were carried on for about two years, and were discontinued in consequence of the mines being exhausted, and the expense of draining off the water. It has now (1840) reverted to its original purpose of irrigation, and is still the property of the Potail who originally caused it to be dug. This venerable old Hindoo, Chinnana Gouda, whose hair and beard are blanched by age, paid me a visit at the mine. He informed me that it is upwards of forty years ago since he dug it; and that, until Mr Heath's discovery, about twenty-two years ago, he had not the slightest idea of the treasures contained in his own well, and of which he had been robbed for eighteen years by the people he employed.

In India, the beryl appears to be almost confined to this particular district. The natives, however, inform me that it occurs at Vaniambadi, at the northern base of the Nilgherries, in rocks of a similar age and petrographical character. In Europe it occurs also in the primitive rocks—in the granite and gneiss formations.—*Edinburgh New Philosophical Journal, October* 1810—*January* 1841.

XI.—*On the Functions of the Colouring Matter of the Skin in the Dark Races of Mankind.*—*By* ROBERT MORTIMER GLOVER, M. D., Lecturer on Chemistry in the Newcastle-on-Tyne School of Medicine.

Various hints and hypotheses have been put forth as to the functions performed by the peculiar organization of the skin in the dark races of mankind. The opinions of Sir Everard Home, published in the Philosophical Transactions for 1821, have been generally adopted by physiologists as apparently founded on a methodical attempt to investigate the subject by direct experiment, and to elucidate it by analogical reasoning. The experiments of Sir Everard give results certainly quite opposed to what has been determined by physical observers respecting the laws which affect the radiation from, and absorption of, heat by coloured surfaces. This circumstance drew my attention to the subject, and led me to repeat some of the experiments related by Sir Everard.

It may be mentioned, before entering on the subject, that this inquiry was proposed by Lord Bacon.

The structure of the skin and of its layers is yet involved in some doubt as to many particulars; but so far as our inquiry is concerned there is no doubt whatever. It is clear that there is a spongy or vascular layer between the cuticle and true skin; or on the surface of the latter, constituting a portion of it. It is also certain that the colouring matter of the skin resides in this region. And that the intensity of shade is the greater or less abundance of the colouring matter. Hence the European and the Negro furnish extreme instances in this inquiry; since in the one the colouring matter is in small quantity or of light shade, whereas the other has it so abundantly that in him we speak of the *pigmentum nigrum*. Between these extremes exist many curious varieties, in whom the functions of the colouring matter are well worthy of consideration, but we have data to reason only with regard to the European or White, and the Negro. Indeed, in many of the coloured races, the existence of something analogous to the dark pigment is only inferred, although the occurrence of Albinoes in all races should induce us to believe the presence of a pigment universal. So that what is said of the colouring matter in the Negro may be extended to all varieties of colour, reasoning by analogy. .

It is scarcely possible to regard the dark colouring matter otherwise than as a provision for, in some way, enabling those who possess it in abundance to withstand the heat of the climate they inhabit. Accordingly, there are facts which prove such individuals to be more capable of withstanding the heat of torrid regions than acclimatized Europeans, or other whites born there. There are also facts to connect this power of withstanding excessive heat with the development of the dark colouring matter. Thus, Albinoes of Guinea, differing from both Europeans and their countrymen in this, that they totally want the colouring matter, according to many authors, are even less capable of resisting the heat of their native country than European strangers; indeed their skins are said to crack and blister on exposure to the sun's rays. And I am informed by Mr. Granidge of Barbadoes, that he has observed the same fact in that island.

Now, when we reflect that the European cannot be without some colouring matter between the true skin and cuticle, since he must differ in this respect from the Albino, it seems as if a relation were established between the development of the pigment, and probably of the rete mucosum along with it, and the power of resisting the sun's heat in torrid regions.

It is clear that in this inquiry we should regard, not merely the physical properties of the organization we consider, nor its vital properties only, but the action and reaction of the whole, and their effect on the system of the individual. For want of a consideration of all circumstances, before the publication of Sir Everard Home's views, it was not conceived how the tint, which, on analogy, should absorb more heat than any other, could, in the hottest regions of the earth, confer any exemption on its possessor. And perhaps before this paper is concluded, it may be apparent that, since Sir Everard published, the matter has been misunderstood.

The notions entertained at present by physiologists, with regard to the operation of this pigment, are implicitly those of Sir Everard. And what they are, will appear from the following brief quotation from an elementary work:—"The secretion on the cutis vera, which gives the black colour to the skin, appears to assist in fitting men for residence in hot climates, because although such skin, by absorbing more caloric, rises to a higher temperature under the sun's rays than white skin does, yet it does not inflame so readily from a rise of temperature." Dr. Alison's meaning is, that although the skin of a negro may rise to a higher temperature under the sun's rays than a white skin in the same circumstances, yet the dark skin is less likely to inflame at *that higher temperature* than the white skin at *that lower one*. This, then, is the conclusion of Sir Everard Home, whose paper I now proceed to examine.

The paper of Sir Everard Home contains alleged facts and experiments, tending to prove the Negro more capable of withstanding excessive heat of the sun's rays than the white man, and attributing this to a supposed property in dark surfaces of destroying the scorching and blistering effect of the sun's rays. The former conclusion has already been admitted. The facts by which Sir Everard supports his second position are to be considered.

Sir Everard having fallen asleep on the deck of a vessel exposed to a tropical sun, found, on awaking, his thigh scorched through a pair of *thin* white linen trousers. From this simple observation, the extravagant conclusion is drawn of black being a better protection against the sun's rays than white.

An experiment is next related, in which Sir Everard found, on exposing his hand to the sun's rays for 45 minutes, while a thermometer attached to it stood at 90°, that blisters rose and coagulated lymph was exuded. I have attempted to produce the same effect by the concentrated rays of the sun at the same temperature indicated in a similar way, and kept up to within one or two minutes of the time, when my patience was exhausted, without any result except slight reddening. Six years ago, while off the coast of Algiers, I sat for half an hour immoveable in the sun, having the greater part of my face exposed, the thermometer in the sun's rays being considerably above 100°, and though my face was scorched, nothing like the effect described by Sir Everard took place.

Sir Everard next attempted to compare the inflaming and blistering power of the sun's rays with that of hot water. He says, that water at the temperature of 120° was painful to the body, and became unbearable when still further heated. From this experiment and the preceding, he wishes us to infer a power of vesicating in the sun's rays not in proportion to their temperature.

In a third experiment, he exposed the backs of his hands to the sun with a thermometer on each, the one hand being uncovered, while the other had a covering of black cloth under which the thermometer was placed. After ten minutes, the degree of heat on each was marked, and the state of the surface examined, and this was repeated three times. During the last trial, the thermometer which had its ball covered by the cloth stood at 106,° while the other was at 98.° The exposed hand was scorched, that covered was unaffected in all the trials. I have not repeated this experiment because it is subject to an obvious fallacy, for the ball of the thermometer being between the cloth and the part, a space intervened, and across this space the heat from the cloth could only pass by radiation or by transmission through the thermometer, but not directly from the cloth to the hand, so that the heat might not accumulate on the skin.

In a fourth experiment, a Negro bore the sun's rays on his hand when a thermometer on the part indicated 100° without any scorching being the result. As the scorching of which Sir Everard speaks could be only a slight blush, it might not be observed on a sable skin. However, I do not question the result of this experiment.

Sir Everard observed in his next experiment, during the course of an eclipse, as the darkness on the sun's disk diminished, the scorching power of the rays, concentrated by a lens, increased in a ratio which is assumed to be greater than could be accounted for by the mere rise of temperature during the time of the experiment. Whence it is to be inferred that the excess of effect is due to the increased quantity of light present with the heating rays at each advance of time. A reference to the original paper will convince the reader that this assumption is established without sufficient data.

Most stress has been laid by Sir Everard, and those who have adopted his views, on the seventh experiment. We are told that, on the 9th of September, at 11 A. M., thermometer 90° in the sun, the concentrated rays applied to a piece of black kerseymere wrapped round the arm, gave no real pain, as it is expressed, during 15 minutes; and at the end of that time left no appearance on the arm; whereas, when white kerseymere was substituted, during the same time, and the concentration we are led to suppose being the same, the heat of a thermometer in the sun only 86°, yet blisters were formed From this experiment, taken along with those preceding, it is supposed to be fully proved that although black surfaces rise to a higher temperature than white under the sun's rays, yet they scorch the surface of the body less; the scorching effect depending on a union of the rays of heat with those of light, the latter being supposed, by way of explanation, to be excluded by the black surface. First, I shall state my repetition of the experiment, and then attend to Sir Everard's explanation of his supposed fact.

I have attempted to ascertain the rise which the absorption of heat by black and white cloths respectively gives to the thermometer; to compare this observation with the effects of the same cloths under the sun's rays upon the body, and with the effect of the sun's rays on the naked skin. When the thermometer stands at about 80° in the sun, the solar rays concentrated on white cloth over the ball of a thermometer, to a space of an inch and a half in diameter by a burning-glass, caused a rise of the thermometer to 125° in a quarter of an hour. When black cloth was substituted the rise during the same period was to 172°. In five minutes, with the white, the rise was to 108°, with the black to 140°; and in some experiments in a proportion nearer that given by the longer period.

When the black and white cloths were applied to the skin at the same temperature, and with the same degree of concentration, as already mentioned, the black cloth generally caused intense pain in the course of a few minutes, and on being allowed to remain for five or at most seven minutes, produced blisters. During the same period very little apparent effect followed the application of the white cloth, though considerable pain was sometimes produced. The experiment was at different times performed on several individuals, all of whom found the black cloth give the sensation of pain sooner than the white. On the whole, I found nothing like the difference described by Sir Everard, though certainly the vesicating effect of the black surface appeared to be much greater than that of the white. From many experiments I conclude, that the rays of the sun will scorch when they are applied to the surface so as to cause a heat of about 130° and upwards. And from the experiment related by Sir Everard, it appears that hot water is capable of producing a similar effect at that temperature. From all this, I am inclined to deny the existence of a scorching power in the sun's rays, independent of the heat they contain, or at least of the effect they produce on the thermometer. Moreover, if such a power do exist, black cloth should yet scorch more than white, since it will absorb all the rays of light, whereas the other surface will reflect them.

In those experiments which I performed, care was taken to have the white and black cloth nearly of the same density. Sir Everard does not appear satisfied with his explanation of the extraordinary *fact* he relates, for he gives another furnished by Davy, who, indeed, is made to ascribe the alleged difference in vesicating power between black and white surfaces, to the former rendering the heat *sensible*. Were I not quoting from the Philosophical Transactions, a misprint might be suspected. I conclude that a black skin will absorb more heat than a white skin, and were it not for other accompanying circumstances, would produce inconvenience precisely in the ratio of the amount of heat absorbed. It must not be overlooked, however, that in the Negro the pigment is not superficial, but covered by a layer of translucent cuticle. The experiments of Dr. Stark prove that colours absorb heat in proportion to their depth of shade through transparent media. It only remains to show the cuticle to be a medium in the condition of those. For this purpose, I covered the balls of a differential thermometer, one with cuticle, the other with cuticle of the same thickness, having ivory black rubbed on its inner surface; on bringing the thermometer into the sun's rays, the column of liquid descended rapidly in the stem, the ball of which was covered with the blackened cuticle.

It is evident, from the result of experiments which I have related, that a much less degree of heat can be borne when the heat is applied locally, or so that the perspiratory process is not excited over the whole system, than Sir Joseph Banks and others were able to bear in heated apartments where perspiration was fully excited.

This circumstance leads me to offer an explanation of the functions, or, not to speak mincingly, of the *uses* served by the peculiar colouring matter in the dark races. Blumenbach and Dr. Winterbottom concur in stating the Negro to perspire more readily than the European or White, and Dr John Davy, in the 3d vol. of the Medico-Chirurgical Transactions, gives its due influence to this property. After noticing that the excessive perspiration in dark people must keep down the temperature, he proceeds, " In the inhabitants of the tropics, the exhalant arteries of the skin seem unusually expanded, and the whole apparatus peculiar to this secretion unusually developed; and I believe that the blood itself is less viscid, more fluid, and flows more readily through the vessels, so as to promote perspiration, and by that means contributing to the cooling of the surface, and being cooled itself, it contributes again when it flows back upon the heart, to the reduction of the temperature of the internal parts."

Were the inhabitant of the tropic not possessed of this organization, his system could not respond to the stimulus of heat, by a determination of fluid to the surface of the body. And the heat absorbed by the skin being prevented from entering the system by the perspiratory process, the greater radiating power of a dark skin must be beneficial in cooling.

Again, the dark skin places the Negro in the conditions of his climate by causing him to radiate heat at night, and become at that time cooler than a White in the same circumstances. This is a fact which has been observed of the Negroes. Their propensity for exercise in the open air at night has been remarked. Thus we read that when the fleet of Hanno approached the shores of Negroland, the country which, during the day, presented only silent woods without the least trace of man, at night was lighted up with immense fires, while the woods resounded with the sounds of festivity. In a climate where, during the day, vegetation appears burnt up, the earth is cracked by the heat, and all living creatures languish; but where at night breezes refresh the air, and cheer exhausted nature, plants run with dew, and animals leave their haunts, man also, fitted by the structure of his skin to throw off heat, issues forth animated by the irresistible propensity to exercise which is always given by the bracing air of colder climates.—*Edinburgh New Philosophical Journal, October* 1840.—*January* 1841.

XII.—*Proceedings of the Madrás Literary Society and Auxiliary of the Royal Asiatic Society.*

Thursday Evening, 6*th August* 1840.—A. D. CAMPBELL, ESQ. *President of the Committee of Papers, in the Chair.*

The following works, presented to the Society, were laid on the table, and thanks voted to the donors:—

Transactions of the Geological Society of London, Second Series, parts 1st and 2d of vol. 5th.—By the Society.

Journal of the Asiatic Society of Bengal for December 1839 and January 1840.—By the Society.

The Calcutta Journal of Natural History, No. 2.—By the Editor.

Dr. Corbyn's India Review, No. 50.—By the Editor.

Journal Asiatique for January 1840.—By the Society.

Asiatic Journal for March and April 1840.—By the Editor.

The following communications to the Society were laid before the Meeting:—

A notice, accompanied with a diagram, of the rocks passed over during a march from Secunderabad to Ahmednuggur in the Dekkan.—By Assist. Surgeon Balfour, 4th Battalion Madras Artillery.

An attempt to enumerate and form a Diagram of the Rocks near the Cantonment of Secunderabad—drawn up in 1838—By the same.

Some particulars respecting the statue of Sir Thomas Munro—By C.

On the basaltic granite of the Barramahal and the Basalt dykes of India, with a sketch—By Captain Campbell, Assistant Surveyor General.

Note on the Chenchu Wandlu or wild people of the Nulla Mulla hills. —By Lieutenant Newbold.

Note on the defaced state in which the statues of the Jains are now generally found,. as connected with their persecutions and overthrow.—By the same.

Note on an ancient Hindu Grant—By Walter Elliot, Esq.

The following letter from the Right Honourable the Earl of Munster was read.

SIR,—I beg to apologize for addressing you, but, my object in so doing being of an interesting literary nature, I trust that you will not only forgive my thus intruding on your valuable time, but that you will (as *much depends* on your *co-operation*), kindly, and warmly, enter into my views.

I have been for many years employed in collecting materials for a Military History of the Mahomedan nations, from the rise of their founder till the present time, and have already made great progress in all details relative to the different people, who have embraced that religion, whether of Arabian or Tartar origin.

I have lately drawn up, in Arabic, a list of military and historical books, which I am desirous to procure, and have accompanied it with a military notice, of some length, in order to point out the subject of the works, which would be most adapted to my researches.

Perhaps you may be so situated, as to assist me in its dissemination, and although I am fully aware of the difficulty that surrounds an attempt of this nature in some Mahomedan cities, yet I hope you may have formed an acquaintance with some Sheick or learned man, who might be persuaded to aid in searching for, and purchasing for me, the books I require.

Should such a person exist, I shall be grateful if you will, with whatever precaution or secresy that may be deemed necessary, put the accompanying Memoir into his hand, and invite him to meet my wishes, by procuring for me the class of historical and military works, named or indicated in it, not only in Arabic, but in Turkish, Chagatai or Tartar, in Persian, Hindostanee, and in all the indigenous languages of India.

But, not only do I look for books, but I should be greatly pleased and aided, by any learned and intelligent Mahomedan gentleman or officer (some of the latter of Western Asia having been of late years educated in Europe) referring to my military memoir, and answering my questions, one by one, and if he would give me in writing the information I desire, including all military technical synonimous terms, of the present as well as of past times.

It is possible, in Egypt, Western Asia and Persia, and still more likely in India, that some European gentlemen from long residence in those countries, may be equal to answering the various *items* of my Memoir. I have reason to believe, that there are several intelligent European Officers in the armies of the Osmanli, of Mahomet Aly Pascha and of Persia—thus situated—while in India, many Civilians and Officers of the India Company's Service, I know to be highly qualified to give me the aid I solicit, and who might, from advantages of vicinity and other circumstances, enter fully upon the Mahomedan art of war in India, of all past centuries, to the present time.

If any gentleman in India, would thus enter into my views, I would particularly point out (besides the past art of war of Persian and Tartar origin and the collection of the past and existing military terms and expressions, of the present native camps and armies) the ancient indigenous Hindoo mode of warfare, previous to, and wholly unconnected with, that introduced by their northern conqueror, and to the military terms (not forgetting the modern) either in the Sanscrit, or as preserved in its cognate existing languages.

I need hardly say, that I shall not be backward in acknowledging, both privately and publicly any such assistance.

I have limited the notices in my Memoir, to the end of the temporal power of the Eastern Khalifs (334 H.); considering the details I have brought forward, sufficient to be a guide for similar researches in after periods and dynasties, and which I wish to be equally illustrated, whether of the Ommiades of Spain, of the Fatimites of Egypt, of the minor kingdoms of the West of Asia on the decline of the court of Bagdad, of the Siljuks, of the Moguls of Ghinges Khan, of Persia, and, of farther East—of the Ghisnivides, Gearides of the Pitan Kanes, and of the family of Timour, at Delhi, and of the numerous sovereignties both of Hindostan and of the Dekkun.

I have reason to believe that the price of books (whatever it may be in Persia, India, or Cabul) in Western Asia, is far from exorbitant, having just received two volumes from Egypt of considerable intrinsic value, for which I only paid 123 Piastres or 23 shillings, and would not wish you (as I am making similar purchases throughout the Mahomedan world) to give, on ordinary occasions, above one pound or 30 to 100 Piastres, for a single volume.

But as some peculiarly scarce, interesting and valuable works, may be offered, I shall beg of you to use your own discretion, as to their prices and immediate purchase, or in first letting me know, what is asked for them or in that of the alternative of having them, if possible, copied.

You may rest assured, I shall be perfectly satisfied with your decision, and shall be grateful, (should you be inclined to meet my wishes) if you will, as soon as you have ascertained that the books selected are pertinent to my objects, to pay for them, and I will instantly on receiving your letter, transfer the amount to your Bankers in London, including any expence on their transmission to 13 Belgrave Street, London—the mode of which, I must leave to your friendly arrangement.

I have the honour to be,
Sir,
Your obedient Servant.
(Signed) MUNSTER.

Lord Munster's communication is referred to the Committee of Papers, who are requested to further by all means in their power the wishes of his Lordship.

Read the following letter from the same Nobleman, accompanying his *Index* of books desired.

SIR,—I trust the Literary Society of Madras will kindly accept the accompanying Memoir, rather as a literary curiosity than for any actual merit it possesses, but I trust the subject and object—for which I have drawn it up, will attract the notice of some of the Society's Members and cause them to aid my views and wishes.

Trusting I shall hear from you to that effect,
I have the honour to be,

Sir,
Your obedient Servant.
(Signed) MUNSTER.

PARIS, 3d May 1840.

Resolved, that every assistance in the Society's power be afforded to his Lordship.

Read a letter from Lieutenant J. Whitlock, 8th Cavalry, forwarding a spherical sandstone concretion, from the red marle cliffs of Dawlish in Devonshire, which he supposes to be of the same character as those described in the proceedings of the Society's Meeting of the 13th of February last, as having been found in the laterite formation at Streepermadoor:— offering, also, to procure for the Society specimens of the Alcyonites found at Gurrah, near Nagpore.

The thanks of the Society were voted to Lieutenant Whitlock for his donation, and an assurance that the promised fossils will be thankfully received.

Read extract from a letter from Lieutenant T. J. Newbold, dated Suez, 31st May 1840, forwarding for the Society's Museum minerals from the shores of the Red Sea.

The thanks of the Society were voted for the same.

Read a letter from the Secretary to the Geological Society expressing thanks for the donation of the Society's Journal No. 23.

Thursday Evening, 3d September 1840—*Captain* J. T. SMITH, *in the Chair.*

The following works, presented to the Society, were laid on the table, and thanks voted for the same:—

Transactions of the Agricultural and Horticultural Society of India—vol. 7th—By the Society.

Journal of the Asiatic Society of Bengal, Nos. 13 and 14—By the Society.

Corbyn's India Review and Journal of Foreign Science and the Arts, No. 53, August 1840—By the Editor.

Topography of Calcutta—By Dr. Strong, presented, on the part of the author, by D. Ross, Esq.

The following communications to the Society, were laid before the Meeting:—

Continuation of the Catalogue of the birds of Southern India, by T. C. Jerdon, Esq.—Tribe Conirostres.

Mr. Elliot's notice of some Roman coins found near Sholapoor.

Horary Meteorological Observations made agreeably with the suggestions of Sir John Herschel.

1*st.—At the Madras Observatory on the* 21*st June* 1840.

1840.	Time.	Barometer.	Thermometer.		Direction of wind.	Strength of wind.	Remarks.
			Dry.	Wet.			
June 21	6 A. M.	29,816	86,5	12,0	s w	2	Thick haze—strong wind.
	7	840	86,9	11,9	w	2,3	Haze do. do.
	8	850	87,9	12,5	w	3	Do. do. do.
	9	862	90,0	14,0	w	3	Do. do. do.
	10	860	91,0	14,8	w	3,4	Do. do. do.
	11	843	92,9	16,3	s w	4	Fl. clouds do. do.
	12	824	95,7	18,7	w	3	Do. do. do.
	1 P.M.	818	97,7	20,2	w	3	Do. do. do.
	2	792	98,7	21,0	w	3	Do. do. do.
	3	770	99,7	22,1	w	4	Do. do. do.
	4	756	99,8	22,4	w by N	3	Cloudy.
	5	758	98,2	21,4	sw by w	2,3	Do.
	6	764	98,0	21,5	s s w	2	Do.
	7	790	96,4	19,4	s w	1	Do. gentle wind—lightn.
	8	800	89,8	7,9	s w	1	Do. do. do. do.
	9	810	93,8	17,3	s w	2,3	Do. strong wind—thr. & lt.
	10	848	94,3	18,8	w	2,3	Do. do. lightning
	11	846	93,0	17,6	w	2,3	Do. do. do.
	12	832	92,0	16,0	w	2,3	Thick haze, strong wind, ltn.
	1 A.M.	804	89,0	14,0	w	3	Do. do. do. do.
	2	786	87,5	12,4	w	3,4	Do. do. do. do.
	3	778	87,0	12,1	s w	3	Do. do. do. do.
	4	772	86,2	11,2	sw by w	3	Do. do. do. do.
	5	790	85,9	10,9	sw by w	3	Do. do. do. do.
22	6	800	85,4	10,5	sw by w	3	Do. do. do. do.
	7	806	86,4	11,2	sw by w	2,3	Do. do. do. do.
	8	810	88,4	13,2	sw by w	3,4	Haze—strong wind.
	9	816	90,3	14,3	w	4	Haze—very strong wind.
	10	820	92,3	15,4	w	4	Fl. cl.—very strong wind.
	11	808	92,8	16,3	w	4,5	Fl. cl. do. do. do.
	12	774	95,7	18,3	w	4	Fl. cl. do. do. do.
	1 P.M.	750	97,7	20,2	w	4	Fl. cl. do. do. do.
	2	726	98,9	21,9	w	4	Thick hz.—very strong wind.
	3	734	100,5	23,5	w	3	Cloudy—strong wind.
	4 ●	682	100,3	23,5	w N w	2,3	Cloudy.
	5	678	100,0	23,3	w by s	3	Cloudy.
	6	702	98,2	21,9	w s w	2	Cloudy.

2d.—*At the Trevandrum Observatory at the Autumnal Equinox* 1840.

Date.	Hour.	Newman's Standard bar. corrected for temp. 32° and for capillarity.	Standard thermometer.	Depress. of wet bulb. thermometer.	Dew point.	Direction of wind.	Velocity of the wind.	Solar radiation.	Clouds, aspect of the sky and remarks.
Sept. 21	6 A.M.	29.671	73.8	2.4	70.27	N. w by w.	3		Sky rather clear cold wind.
	7	.697	75.2	2.6	71.43	do.	3	2.5	Do. do.
	8	.714	77.0	3.6	71.82	do.	5	3.0	Do. gentle wind.
	9	.715	79.5	4.9	72.52	do.	5	5.5	Flying clouds. do.
	10	.715	81.5	6.4	72.40	do.	5	4.5	Do. do.
	11	.687	84.0	7.9	72.85	do.	5	Cly.	Do. do.
	Noon.	.664	85.0	7.9	73.97	do.	5	7.0	Do. do.
	1 P.M.	.641	85.6	9.0	72.95	w.	3	2.5	Do. cumuli about hor. do. increasing.
	2	.615	85.0	9.2	71.94	do.	6	8.0	Do. do. pleasant wind.
	3	.609	84.7	9.1	71.75	do.	3	3.0	Do. do. gentle wind.
	4	.606	83.9	8.1	72.43	do.	4	3.3	Do. do. do.
	5	.628	81.8	6.0	73.34	do.	4		Sky cloudy do.
	6	.613	79.9	5.4	72.19	do.	2	No observation.	Sky getting clear light air.
	7	.668	78.8	4.3	72.68	w. by N.	2		Sky pretty clear do.
	8	.697	78.2	4.4	71.88	do.	1		Do. do.
	9	.715	77.7	4.2	71.65	do.	1		Do. do.
	10	.726	77.2	3.7	71.88	do.	,,		Sky getting cloudy calm.
	11	.709	76.4	3.1	71.94	do.	,,		Cloudy do.
	Mid.	.707	76.0	2.7	72.12	do.	,,		Do. do.
,, 22	1 A.M.	.681	75.6	2.1	72.59	w.	2		Do. at 1h. 10m. rain—wind just perceptible.
	2	.652	75.4	1.6	73.12	do.	,,		Zenith clear nearly calm.
	3	.649	75.2	1.5	73.06	do.	,,		Sky rather cloudy. do.
	4	.647	75.0	1.7	72.56	do.	,,		Do. do.
	5	.651	74.3	1.7	71.84	do.	,,		Do. do.
	6	.672	74.5	1.6	72.19	N.w by w.	2		Do. light air.
	7	.687	75.9	1.5	73.78	w N. w.	2	0.5	Do. do.
	8	.690	77.2	2.4	73.81	N. w by N.	5	1.8	Do. gentle wind.
	9	.701	79.2	3.1	74.87	w. by N.	4	4.3	Flying clouds do.
	10	.688	81.0	4.7	74.43	w.	3	Cly	Cloudy do.
	11	.665	82.2	5.5	74.53	do.	6	9.0	Thick cumuli rising; pleasant do.
	Noon.	.642	84.6	7.1	74.73	do.	3	8.8	Sky getting clear gentle do.
	1 P.M.	.609	85.5	8.1	74.21	do.	4	11.0	Do. do.
	2	.587	85.0	7.9	73.97	do.	4	9.5	Do. do.
	3	.570	85.5	8.4	73.76	do.	4	3.5	Cirrus in the zenith; cumuli about the hor. gentle wind.
	4	.567	85.0	9.6	71.29	do.	3	4.5	Clear do.
	5	.582	82.0	7.7	70.91	do.	3	2.5	Very clear do.
	6	29.606	79.8	5.1	72.54	do.	3		Do. do.

September 21st rain fell from 6 A. M. to 6 P. M. None.
do. 6 P. M. to 6 A. M. ·0421.
September 22d do. 6 A. M. to 6 P. M. None.

Total. ·0421

The Instruments are the same, and situated exactly as before.

G. SPERSCHNEIDER, *Superintendent.*

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY; FOR THE MONTH OF APRIL, 1840.

Days.	Barometer at			Ther. at			Wet bulb.			Rain.		Evaporation.	Strength of wind.	Direction of Wind.			Cloudy Max.	Weather.		Remarks.
	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	Sun-rise.	Sun-set.			10 A. M.	4 P. M.	10 P. M.		10 P. M.	4 P. M.	10 P. M.
1840	Inch.	Inch.	Inch.	°	°	°	°	°	°											
Apr. 1	30,114	30,003	30,082	83,5	85,6	83,0	5,3	8,2	5,0	......	......	2,478	2,3	E	S E	S E	1	Clear.	Clear	Clear dew.
2	,150	,010	,082	83,7	86,0	82,8	6,2	7,0	4,3	......	......	......	2,3	S E	S. S E	S	1	Fl. cl.	Clear	Clear do.
3	,102	29,945	,022	84,0	87,0	83,6	5,7	8,0	5,2	......	......	......	2,3	S	S E	S	1	Clear	Clear	Clear do.
4	,038	,948	,016	84,5	86,0	83,1	6,4	6,2	3,2	......	......	......	2,3	S	S E	S E	3	Clear	Clear	Fl. cl.—lightning. do.
5	29,998	—	29,992	86,0	—	84,0	6,5	—	2,5	......	......	......	2,3	S W	—	S E	3	Clear	—	Haze do. —
6	30,022	29,916	30,000	86,0	87,0	84,0	6,5	7,0	4,0	......	......	......	2,3	S	S by E	S	2	Fl. cl.	Clear	Clear do. —
7	,034	,900	29,982	85,6	87,4	84,2	5,6	6,7	3,2	......	......	......	2,3	S W	S E	S E	3	Fl. cl.	Clear	Fl. cl. do. —
8	,002	,897	,972	85,6	87,6	84,0	7,2	7,8	4,5	......	......	2,833	3	S W	S E	S E	2	Fl. cl.	Clear	Clear do. —
9	,014	,903	,968	86,0	86,2	83,9	6,6	6,2	4,0	......	......	......	3	S	S. S E	S E	2	Clear	Clear	Clear do. —
10	,020	,900	,974	85,7	87,0	84,0	6,2	8,4	4,0	......	......	......	2,3	S	S	S	2	Fl. cl.	Clear	Clear do. —
11	,000	,882	,956	85,5	87,0	83,8	7,7	7,0	3,3	......	......	......	2,3	S	S. S E	S E	1	Fl. cl.	Clear	Clear do. —
12	,000	—	,992	86,0	—	35,5	2,5	—	4,1	......	......	......	2,3	S	—	S E	1	Fl. cl.	—	Clear — —
13	,016	,907	30,000	86,5	88,3	84,5	7,0	—	3,5	......	......	......	2,3	S	S E	S	1	Fl. cl.	Clear	Clear — —
14	,012	,888	29,978	86,8	88,0	85,0	8,4	6,7	4,0	......	......	......	2,3	S W	S E	S	1	Clear	Clear	Clear—lightning —
15	29,962	,858	,920	86,8	87,0	84,4	7,3	5,5	2,9	......	......	......	2,3	S W	S E	S	1	Clear	Clear	Clear —
16	,962	,838	,922	87,5	89,0	85,2	8,0	8,3	3,3	......	......	......	2,3	S W	S E	S	2	Clear	Clear	Fl. cl. —
17	,966	,870	,958	86,6	87,0	83,9	4,6	5,5	3,6	......	......	......	2,3	S. S E	S E	—	2	Clear	Clear	Haze —
18	30,018	—	30,044	85,3	—	85,9	5,9	—	4,6	......	......	......	2,3	S	—	—	2	Clear	—	Clear —
19	—	—	,000	—	—	85,9	—	—	4,2	......	......	......	2,3	—	—	S E	1	—	—	Clear —
20	—	—	29,926	—	—	84,3	—	—	3,4	......	......	......	2,3	—	—	S	1	—	—	Clear —
21	29,943	29,783	,842	86,5	86,4	84,0	8,1	5,0	3,5	......	......	3,011	3	S W	S E	S E	2	Clear	Clear	Haze—lightning.
22	,842	,770	,864	88,5	86,3	85,9	9,0	5,5	4,5	......	......		2,3	S W	S E	S E	2,3	Haze	Haze	Haze do.
23	,914	,809	,862	87,7	88,0	84,2	7,7	7,3	3,8	......	......		2,3	S E	S E	S E	2	Fl. cl.	Clear	Clear do.
24	,898	,755	,848	87,8	88,2	85,7	8,4	6,7	3,7	......	......		2,3	S W	S E	S E	2	Fl. cl.	Th. hz.	Haze —
25	,838	,710	,790	89,8	88,0	85,9	0,9	6,3	2,1	......	......		2,3	S W	S E	S W	2	Clear	Clear	Haze—lightning
26	,770	—	,766	89,8	—	87,3	10,8	—	4,8	......	......		2,3	S W	—	S	2,3	Haze	—	Fl. cl. land-wind th. and lightn.
27	,734	,614	,706	91,8	91,0	89,7	2,3	6,5	6,7	......	......		2,3	W	S E	S. S W	4	Clear	Haze	Haze th. and vivid lightning.
28	,728	,628	,720	93,0	90,0	88,4	5,3	—	6,4	0,025	......		2,3	N. N W	S E	Calm	3	Clear	Clear	Thick haze ; lightning.
29	,698	,605	,684	90,7	91,3	89,2	8,9	9,8	4,7	......	......	3,280	2,3	N. N W	S E	S	4	Haze	Haze	Haze lightning.
30	,696	,568	,680	90,1	99,0	89,8	9,3	9,4	5,4	......	......		2,3	W	S E	S	3	Haze	Th. hz.	Haze—vivid lightning.
Mean	29,946	29,829	29,918	87,0	88,1	85,2	6,6	7,0	4,1											

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY ; FOR THE MONTH OF MAY, 1840.

Days.	Barometer at 10 A. M.	Barometer at 4 P. M.	Barometer at 10 P. M.	Ther. at 10 A. M.	Ther. at 4 P. M.	Ther. at 10 P. M.	Wet Bulb. 10 A. M.	Wet Bulb. 4 P. M.	Wet Bulb. 10 P. M.	Rain. Sun-rise.	Rain. Sun-set.	Evaporation.	Strength of wind.	Direction of Wind. 10 A. M.	Direction of Wind. 4 P. M.	Direction of Wind. 4 P. M.	Cloudy Max.	Weather. 10 A. M.	Weather. 4 P. M.	Remarks. 10 P. M.
1840	Inch.	Inch.	Inch.	o	o	o	o	o	o											
May 1	29,744	29,643	29,798	91,8	93,0	86,5	8,3	11,7	6,1	......	......	......	2,3	w	s	s. s e	2	Haze	Haze	Haze—lightning.
2	,836	,750	,858	89,8	89,0	87,8	11,8	6,8	6,4	......	......	......	2,3	w	s	s	3	Clear	Cloudy	Fl. cl. do.
3	,888	———	,832	88,6	—	90,3	9,2	—	7,3	......	......	......	2,3	s w	———	s	3	Clear	Cloudy	Fl. cl. do. and thunder.
4	,854	,714	,800	91,5	94,0	88,2	12,5	13,6	6,2	......	......	......	2,3	s w	s e	s. s w	3	Clear	Cloudy	Fl. cl. do. do.
5	,864	,743	,812	92,0	93,0	88,2	12,4	13,3	6,7	......	......	......	2,3	s w	s e	s. s w	3	Clear	Cloudy	Clear do. do.
6	,890	,800	,876	90,9	90,7	86,4	11,5	8,2	3,8	......	......	3,492	2,3	swbyw	s w	s	3	Clear	Cloudy	Th. hz. thunder in the evening.
7	,900	,790	,860	91,0	92,0	89,2	12,1	10,0	6,7	......	......	......	2,3	s w	s w	s w	3	Cloudy	Cloudy	Clear, thunder, lightning and drizzling rain at 5 P. M.
8	,872	,770	,834	92,5	93,0	91,0	16,0	10,3	8,0	......	......	......	2,3	w	s w	s	3	Clear	Cloudy	Fl. cl. thunder at 4 P. M.
9	,866	,766	,834	89,7	89,7	89,4	9,3	12,4	19,3	......	......	......	2,3	w	n w	w	4	Fl. cl.	Cloudy	Th. hz. do. lightning and drizzing rain at 4. P. M.
10	,876	———	,866	89,5	—	89,0	9,2	—	5,4	......	......	......	2,3	w	———	s	3	Clear	———	Th. hz. lightning.
11	,896	,782	,890	89,3	89,6	86,6	11,8	8,9	3,2	......	......	......	2	swbyw	s w	s w	2	Haze	Th. hz.	Clear do.
12	,916	,810	,902	88,1	89,8	88,6	9,2	7,8	4,9	......	......	......	2,3	s w	s w	s	2	Haze	Th. hz.	Haze do. th. hz at night.
13	,938	,808	,916	88,6	89,0	86,7	10,0	7,6	4,2	......	......	3,808	2,3	s w	s w	s	2	Clear	Th. hz.	Clear do. th. hz. at night.
14	,916	,810	,908	90,3	90,0	87,4	11,4	9,3	5,4	......	......	......	2,3	s	s	s	2	Clear	Haze	Haze ———
15	,927	,796	,862	91,0	92,0	86,3	13,5	12,0	5,9	......	......	......	3	s w	s	s. s w	0	Clear	Haze	Clear ———
16	,892	,766	,830	92,4	91,6	86,6	13,4	11,8	6,6	......	......	......	2,3	swbyw	s. s w	s. s e	2	Clear	Clear	Clear lt. strong wind at night.
17	,844	———	,854	93,0	—	91,0	12,0	—	12,4	......	......	......	2,3	w n w	———	s	3	Clear	———	Fl. cl. loud th. and vivid lightn.
18	,928	,796	,876	82,8	89,7	85,9	5,3	8,2	5,9	......	......	......	2,3	swbyw	s w	s	3	Cloudy	Clear	Haze lightning.
19	,888	,778	,838	88,2	91,3	87,2	8,2	10,3	5,2	......	......	......	3	w	s w	s w	2	Clear	Clear	Clear do. strong wind at night.
20	,842	,735	,810	90,6	91,8	87,0	11,7	11,0	7,0	..	......	3,093	3	s w	s w	s	2	Clear	Clear	Clear do. do. do.
21	,828	,730	,830	90,9	90,8	89,2	13,9	10,0	6,1	......	......	......	4	s w	s w	s	4	Clear	Cloudy	Cloudy do. do. do. and drizzling rain in the morning.
22	,863	,743	,831	91,2	92,0	89,5	11,8	10,0	7,8	......	......	......	3	s w	s w	s w	3	Haze	Cloudy	Th. hz. thunder and lightning.
23	,848	,737	,818	91,8	92,7	87,7	15,9	11,7	7,7	......	......	......	3	s w	s w	s. s w	4	Clear	Clear	Clear lightning.
24	,850	,738	,852	91,0	90,0	89,0	11,5	7,5	7,0	......	......	......	3	s w	s w	s w	2	Clear	Clear	Clear do.
25	,898	,764	,856	90,8	92,0	88,3	12,8	8,0	6,8	......	......	......	2	w	s w	s e	3	Clear	Clear	Clear do.
26	,886	,774	,838	90,3	91,8	90,5	10,8	10,3	9,0	......	......	......	2	w	s w	s w	2	Clear	Clear	Cloudy do.
27	,862	,770	,840	91,7	93,3	90,3	13,7	10,0	9,9	......	......	4,255	3	s. s w	s w	s. s w	3	Clear	Cloudy	Cloudy do.
28	,829	,728	,836	91,7	90,0	89,8	12,9	11,2	6,4	......	......	......	3	s w	s w	s	4	Haze	Cloudy	Cloudy vivid do.
29	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				[illegible]	[illegible]	[illegible]	[illegible]	1	Clear	Clear	Clear lightning. (and night.

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY: FOR THE MONTH OF JUNE, 1840.

Days.	Barometer at			Ther. at			Wet Bulb.			Rain.		Evaporation.	Strength of wind.	Direction of Wind.			Cloudy Max.	Weather.			Remarks.
	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	Sun-rise.	Sun-set.			10 A. M.	4 P. M.	10 P. M.		10 A. M.	4 P. M.	10 P. M.	
1840	Inch.	Inch.	Inch.	°	°	°	°	°	°												
June 1	29,798	29,712	29,786	89,8	89,2	86,7	12,8	7,7	6,7	......	......	......	2,3	S	S E	S W	4	Haze	Cloudy	Fl. cl.	lightning.
2	,812	,710	,790	88,5	90,3	86,2	8,0	6,3	2,7	......	......	......	,2	S	S E	S E	2	Fl. cl.	Haze	Clear	do.
3	,842	,712	,850	88,7	88,3	87,9	5,7	7,3	4,2	......	......	3,346	,2	S.SE	S E	S E	2	Fl. cl.	Th. hz.	Th. haze	do.
4	,864	,760	,850	88,7	90,0	86,8	7,7	8,0	4,1	......	......	.....	,2	E	S E	S E	1	Clear	Clear	Cloudy	do.
5	,824	,723	,814	88,2	89,0	86,3	6,2	8,0	4,3	......	......	......	,2	S.SE	S E	S E	1	Haze	Clear	Clear—vivid	do.
6	,800	,7'3	,826	87,9	88,3	86,3	5,8	6,9	4.8	......	......	......	,2		S E	S E	2	Fl. cl.	Clear	Fl. cl.	do.
7	,808	—	,822	88,5	—	87,5	6,5	—	4,1	......	......	......	,2	E	—	S E	4	Clear	—	Fl. cl.	thunder and lightning.
8	,818	,720	,802	87,8	90,0	87,0	7,3	9,3	4,5	0,077	......	......	,2	S W	S E	S E	2	Fl. cl.	Clear	Fl. cl.	do.
9	,778	,673	,748	90,9	91,2	89,7	4,9	8,2	8,7	......	......	......	,2	W	S E	S	4	Haze	Cloudy	Haze and flying cl.	vivid do.
10	,752	,650	,766	90,0	84,0	89,2	11,5	3,3	9,8	......	......	,985	,2	W	S E	S	3	Haze	Cloudy	Fl. cl.	thunder in the evening lightning at night.
11	,862	,640	,750	90,8	90,0	88,7	12,3	6,8	4,1	......	......	......	,2	N W	E by S	S	2,3	Haze	Cloudy	Cloudy	lightning.
12	,752	,658	,750	84,3	89,0	83,5	5,9	—	4,5	......	......	......	,2	S W	S SW	S W	8	Cloudy	Cloudy	Cloudy	do.
13	,733	,668	,701	83,9	84,0	84,2	5,9	5,2	5,7	0,155	......	......	,2	W	N W	W	9	Cloudy	Cloudy	Cloudy	do.
14	,726	—	,700	86,0	—	85,9	8,3	—	8,4	......	......	......	,2	W	—	S W	9	Cloudy	—	Cloudy	do.
15	,722	,630	,764	88,2	93,2	87,2	12,3	16,2	7,8	......	......	......	,3	W	S W	S W	8	Th. hz.	Cloudy	Cloudy	do.
16	,766	,700	,800	90,2	92,8	89,8	3,3	15,8	5,8	......	......	......	,3	S W	S E	S	7	Haze	Cloudy	Haze	do.
17	,826	,730	,816	90.8	93,3	90,6	12,9	14,3	7,7	......	......	3,013	2,3	S W	SE by S	S	7	Haze	Cloudy	Haze	do.
18	,820	,700	,780	89,0	95,3	91,9	13,1	18,3	9,5	......	......	.....	2,3	W	W.SW	S	6	Haze	Cloudy	Fl. cl.	do.
19	,798	,683	,756	91,0	94,5	91,9	14,1	17,7	9,1	......	......	......	2,3	SW by W	S W	S	5	Haze	Cloudy	Haze	do.
20	,826	,714	,804	91,6	97,8	92,0	14,6	20,3	9.0	......	......	......	,3	SW by W	W by N	S	7	Haze	Cloudy	Fl. cl.	do.
21	,860	,756	,848	91,0	99,8	94,3	14,8	22,4	18,8	......	......	......	,3	W	do.	W	7	Haze	Cloudy	Cloudy	thunder and do. strong wind at day and night.
22	,820	,683	,770	92,3	100.3	94.4	15,4	23.5	16,2	......	......	......	,3	W	W.NW	S W	5	Fl. cl.	Cloudy	Haze	do. do. do. do.
23	,776	,660	,768	91,8	100.0	95,5	15.8	23.0	18,5	......	......	......	,3	W	W by S	W	5	Haze	Cloudy	Fl. cl.	do. do. do. do.
24	,802	,710	,834	92,9	96,8	92,5	16,9	18,8	10,9	......	0,032	5,339	2,3	W	E	S W	6	Clear	Cloudy	Cloudy	do.
25	,852	,758	,852	91.7	93,0	90,0	15,6	13,0	7,0	......	......	.....	2,3	SW by W	E. SE	S	6	Haze	Fl. cl.	Cloudy	do.
26	,888	,780	,854	91,7	92,3	86,6	15,8	9,0	2.1	......	0,217	......	2,3	W.NW	E. SE	S	5	Haze	Cloudy	Fl. cl.	do.
27	,868	,764	,854	90,8	92,0	89,5	12,2	11,5	7,1	......	......	......	2,3	N W	E. SE	S	5	Clear	Fl. cl.	Fl cl.	—rainbow to the west thunder and lightning.
28	,850	—	,842	89,0	—	89,7	11,1	—	7,3	......	......	......	2,3	W	—	S	6	Clear	Fl. cl.	Cloudy	—lightning.
29	,840	,760	,840	91,0	85,8	87,9	12,7	7,8	8,0	......	......	......	2,3	S W	N	S E	5	Fl. cl.	Cloudy	Fl. cl.	thunder in the afternoon
30	,858	,810	,854	89,8	89,0	85,9	11,3	9,5	8,4	......	......	......	,2	N W	W. NW	S W	4	Fl. cl.	Cloudy	Haze	—lightning.
Mean	29,811	29,711	29,800	89,6	91,8	88,9	10,7	12,2	7,7												

The instruments with which the foregoing observations are made, are placed in the Western Verandah of the Honourable Company's Observatory; at about five feet above the surface of the ground, and twenty-seven feet above the level of the Sea: the thermometer was made on purpose for the Observatory, and at 75° (the only point at which a comparison has been made) it was found to differ insensibly from the Royal Society's Standard; the barometer is one of two Standards which have been lately constructed, and may be depended upon to 0,0100 an inch.

J. CRISP, Major.
H. C. Acting Astronomer.

MADRAS JOURNAL

OF

LITERATURE AND SCIENCE.

No. 29—*October* 1840.

I.—*Catalogue of the Birds of the Peninsula of India, arranged according to the modern system of Classification; with brief Notes on their Habits and Geographical Distribution, and description of new, doubtful and imperfectly described Species.—By* T. C. JERDON, *Assistant Surgeon, 2d Madras Light Cavalry.*

(*Concluded from No.* 28 *page* 15.)

ORD. GRALLATORES.—*Waders.*

FAMILY ARDEADÆ.—*Cranes* and *Herons.*

GENUS GRUS, L.—*Crane.*

I shall commence this family with the *Cranes*, which have been accidentally omitted in Swainson's Synopsis.

297.—*G. Antigone,* Edw. pl. 45.—*Sarrus,* H.—*Greater Indian Crane.*

I have only observed this fine bird once or twice on the banks of the Godavery and Kistnah rivers, but extract from Mr. Elliot's notes the following excellent observations, chiefly made in Guzrat, it being but a rare visitant to the Southern Mahratta Country.

" The *Sarrus* lives always in pairs, though several pairs are frequently seen together, and occasionally, though rarely, a stray bird, either a young one, or one that has lost its mate, with another pair. Every morning they are seen at sun-rise winging their way to the cultivated fields, to feed upon grain, their sole aliment—and about 11 or 12 o'clock, they make their way to the nearest water to drink, always preferring the sandy beds of rivers, where they are seen in the greatest numbers, but not disdaining to resort to tanks, should no stream be near. There they remain all day, and at evening again, betake themselves to the fields, returning to pass the night by the water side. When alarmed and when on the wing in the morning flights, they utter a fine clear trumpet-like note."

The *Sarrus* is migratory, appearing in the Peninsula only in the cold weather.

Irides vinous red; bill pale sea green, brownish at the tip; legs rosy red, passing into brown in front. Length 52 inches; expansion of wings 7 feet 9 inches; tarsus 13; bill 6; weight 17 lbs.

From the testimony of Shikaries and others, there appears to be another large *Crane*, which occasionally visits the Peninsula, and from the descriptions I have heard, it is probably the *Grus Torquata* of Vieillot and Wagler.

298.—*G. cinerea.—Ardea Grus*, L.—*Koolung*, H.—*Common Crane.*

The well known *Crane* is found in India in the cold season only, living in pairs or small parties of 6, 8, or more. Has similar habits and food with the *Sarrus Crane.* On one occasion I found the flowers of the Koosoom (*Carthamus tinctorius*) to have been the only food partaken of. This was late in March when most of the grains were cut. The *Koolung* is often seen in company with the next bird.

Irides reddish yellow, brown in some; bill sea green; legs black. Length 3½ feet; expansion of wings about 6 feet; tarsus 8½; bill at front 4.

Sub Genus ANTHROPOIDES, Vieillot.

299.—*A. Virgo.—Ardea Virgo*, L.—*La Demoiselle*, Buff. P. E., 241. —*Kurronch*, H. also *Kurkurrah.—Kurkoncha*, Can.; all named from the call of the bird—*Demoiselle Crane.*

This most elegant, and chastely coloured bird is found over most of the Peninsula, during the cold weather, and in much greater numbers than either of the two last *Cranes*. Like these it is most abundant in the neighbourhood of the larger rivers, and has similar habits and food.

Mr. Elliot in his notes says "Flies in vast flocks—from 50 to 100, and even 500, with great regularity of arrangement, in a long line, a few of the leading ones disposing themselves in another line at an angle, varying from a right to an acute one with it. This is when they are in progress—at other times, as when disturbed during the heat of the day, they may be seen circling round at a great height, but still a regular order of lines may be distinguished. Their favourite food is chenna (*Cicer arietinum*). They never go to tanks to drink but always to rivers." When this bird is struck by a *Bhyree* (*Falco peregrinus*) its mate generally comes to its assistance. The *Bhyree* always strikes it on the back and wings, to avoid being wounded by the sharp inner claw, with which, if struck on the head, it generally manages to inflict severe wounds on the breast of the falcon.

Irides fine vinous red; bill greenish at the base, yellowish in the middle, and inclining to pink at the tip; legs black. Length 2½ feet; expansion about 5 feet; tarsus 6½ inches; bill to front 2 3/10ths.

The inner claw of all these *Cranes* is much hooked, and exceedingly sharp, and it always in self-defence strikes with its claw and never with its bill.

GENUS ARDEA, *Heron*.—*Buglah*, H.

SUB GENUS ARDEA, Swains.

300.—*A cinerea*, Lath.—*A. major*, Gmel.—*Kabood*, H.—*Common Heron.*

The European *Heron* is found all over India throughout the year, frequenting tanks and rivers. It is generally solitary, but is occasionally met with in parties of 4 or 5 together. It breeds in the more wooded districts on the top of lofty tress, during the hot weather, generally 4 or 5 nests being placed together. Length 3 feet; bill at front 5 2/10, at gape 6½; tarsus 6½; centre toe and claw 4¾; hind do. 2½.

301.—*A. purpurea*, Auct. also *A. purpurata*.—*Naree*, H.—*Purpled Heron.*

This species is much less numerous, and less generally spread than the last one. I have seen it most abundant in the wooded western coast in the wet paddy-fields. It is also a permanent resident in India, but I have not yet seen its breeding places.

Irides yellow; bill brown above, yellow beneath; legs yellow, brown in front. Length 30 to 32 inches; bill to front $4\frac{8}{10}$ths inch, at gape nearly 6; tarsus 6; centre toe and claw nearly 6; hind toe $3\frac{1}{2}$.

Sub-Genus EGRETTA, Briss. Swains.

302.—*E. flavirostris.*—*A. flavirostris*, Temm. and Wagl.—*A. Torra*, Buchanan and Franklin.—*A. egretta*, Sykes' Catal.—*Mullung Buglah*, H.—also *Turrur Buglah.*—*Larger Egret—yellow-billed Egret.*

This bird appears to have been first described as distinct by Buchanan (according to Franklin), who named it *A. Torra*—and when without the appendages, *A. putea.* It has, however, been since named by Temminck with a more scientific appellation, which I have therefore adopted.

The large yellow-billed *Egret* is tolerably abundant in most parts of India, frequenting rivers, tanks, marshes, and the inundated paddy-fields.

Length nearly 3 feet; bill at front 4 inches, at gape 5; tarsus $5\frac{1}{2}$; bill yellow; legs black.

303.—*E. alba.*—*A. alba*, Gmel., Lath. and Wagler?—*A. Egretta* of Temm. and others?—*Puttoka Buglah*, H.—*Large black-billed Egret.*

Though I have not hitherto obtained specimens of the large *Black-billed Egret*, I have on several occasions observed it in different parts of the country, always alone. It is probably the *Egret* of Europe, said to be found in numbers in Central Asia.

304.—*E. Garzetta.*—*A. Garzetta*, Auct.—*Keerchea* (or *Kilcheeah*) *Buglah*, H.—*Small Egret.*

This *Egret* abounds over all the Peninsula, occasionally associating in numerous flocks, and frequenting rivers, tanks, paddy-fields, pools of water, &c. &c.

Irides light yellow; bill black; legs do.; feet greenish yellow. Length about 2 feet; bill at front $3\frac{2}{10}$th inch; at gape 4; tarsus 4. It is said by the natives that the bones of this bird, if reduced to powder, and a little employed in the cooking of bony fishes, render the fish bones quite soft, so that they can be eaten with satisfaction!!

305.—*E. asha.*—*A. asha*, Sykes.—*A. jugularis* of Forster and Wagler?—*Kala Buglah*, H.—*Small blue Heron.*

This is a comparatively rare bird. I have seen it but once or twice solitary in small rivers, in the northern part of the table land. My only specimen differs somewhat from Colonel Sykes' description, in having the whole under surface of the body grey, dashed slightly with white on the neck and lower part of the body, chin and throat alone are pure white. It appears to resemble much the description of *Ard. jugularis*, but Sykes pronounces his bird distinct, so for the present I place my specimen under his appellation, as the only recorded similar Indian species. Mr. Elliot in his notes says, " Is common on the western coast at the mouths of rivers."

Irides light yellow; bill brownish horny above, yellowish beneath; legs greenish black; feet greenish. Length about 2 feet; bill at front $3\frac{1}{2}$; at gape $4\frac{2}{10}$ths; tarsus 4.

306.—*E. Javanica.* Sw.—*A. Javanica*, Horsf.—*A. Scapularis*, Wagl. —*Kunchur Buglah*, H.—*Indian Green Heron.*

This pretty little *Heron* differs according to Horsfield and Swainson from the closely allied South American bird (*Ard. Scapularis*) in the comparative length of the toes, and in the legs being feathered close down to the knee. It is only found solitary on the banks of wooded streams, perching in general on a low branch overhanging the water. It is spread over all the Peninsula.

Irides light yellow; bill blackish above, yellowish horny beneath; legs dark green; feet yellow; lores light green. Length 17-18 inches; tarsus nearly 2; bill to front $2\frac{4}{10}$ths, at gape $3\frac{1}{2}$.

307.—*E. Malaccensis.*—*Ard. Malaccensis*, Auct.—*A. Grayii*, Sykes, Hardw Ill. Ind. Zool.—*A. affinis*, Horsf.?—*A. Coromandelica*, Lich.?—*Buglee*, H. also *Undhe Buglee.*—*Marroon-backed Heron* or *White winged Heron.*

The supposed new species of Colonel Sykes, named by him *Ard. Grayii*, I have ascertained to be the summer or breeding plumage of the common *Ard. Malaccensis.* It begins to moult in April or May, and resumes its plain winter livery about September or October. Perhaps the most remarkable circumstance connected with this is the change of colouring the bill undergoes, from the usual plain dusky tint to the three coloured hues it presents during the hot season.

The *Buglee* is a very common and familiar bird, frequenting rivers, tanks, marshes, wet paddy-fields and pools of water—and often seen in the rivers, feeding among crowds of people, bathing and washing, without any alarm or suspicion. It is often struck down by a trained Shikra (*Accip. Dukhunensis*).

Irides light yellow; legs and feet light greenish. Length 19 inches; bill at front 2½, at gape $3\frac{2}{10}$ths; tarsus $2\frac{3}{10}$th inches.

308.—*E. Caboga.*—*Ard. Caboga*, Pennant.—*A. ruficapilla*; Vieill.?—*A. russata*, Wagler?—*Dorreah Buglah*, H.—*Soorheah Buglah* of some.—*Cattle Heron.*

This well known species is generally found in flocks of various size in company with herds of cattle, feeding on grasshoppers, and other insects disturbed by them whilst grazing. It seldom resorts to water like its other congeners, except during the heat of the day. Like the last, it assumes its beautiful golden or ruddy tint on head, neck and back, only during the breeding season.

Irides bright yellow; bill dark yellow; legs and feet blackish. Length about 20 inches.

The specific name is derived from the Hindustani '*Guo Buglah*', meaning *Cow Heron.*

Sub Genus BOTAURUS, Briss.—*Bitterns.*

309.—*B. cinnamomeus.*—*Ard. cinnamomea*, Gmel.—*Lal Buglah*, H. of some.—*Little Chestnut Heron* or *Bittern.*

I have only found this little species at all common on the wooded regions of the western coast, generally in marshy ground, or in the wet paddy-fields. I have also seen it on the banks of the Pykarra river on the Neilgherries, and Mr. Elliot mentions it as common in parts of Dharwar.

Length about 15 inches; bill at front 2, at gape $2\frac{7}{10}$ths; tarsus $1\frac{9}{10}$ths,

310.—*B. Stellaris*, Briss.—*Nir Goung*, H.—*Common Bittern.*

I have not myself hitherto procured a specimen of the *Bittern*, but know that it has been killed near Jaulnah and Aurungabad, in marshy ground. It is enumerated, moreover, both in Sykes' Catalogue and by Mr. Elliot, and the latter gentleman has lately shown me a fine specimen shot on the Neilgherries, during the hot season.

Sub Genus NYCTICORAX, Steph.

311.—*N. Europæus.*—*Ard. nycticorax*, L.—*Wākh*, H.—*Night Heron.*

The *Wākh* is of universal occurrence throughout the Peninsula, but most common in the more wooded regions. It roosts during the day on high trees, often in palm groves, and sallies forth to the waters in the neighbourhood after sunset to feed upon fish, frogs, and other aquatic animals. It breeds on palm and other trees, many nests together. Its Hindustani name is derived from its harsh call.

Irides crimson. Length 21 to 23 inches; tarsus 3; bill at gape 4, at front $2\frac{8}{10}$ths.

GENUS PLATALEA, L.

312.—*P. leucorodia*, L.—*Chumuch Boozah*, H.—*White Spoonbill.*

The *Spoonbill* is tolerably abundant over India, frequenting rivers and tanks, occasionally in numerous flocks, and feeding on various aquatic insects, *crustacea*, small fish, &c.

The Hindustani name signifies '*Spoon Ibis*,' and I think from its manner of feeding, its small gape, and its flight, the *Spoonbill* shews more affinity to the *Ibis* family than to that of the *Herons*, with which most authors associate it.

GENUS CICONIA, Briss.—*Storks.*

Besides the *Mycteria*, already separated from the *Storks*, there appear to be three types (which might be made into as many sub-genera) among the Indian *Ciconiæ*. One is represented by the *white Stork*, a second by the *black Stork*, and a third by the *carrion eating Storks*, or *Adjutants*. The *white-necked stork* appears to be a link between the *white* and *black Stork*, as well in form as in its habits, being partly terrestrial, and partly aquatic in its habits.

313.—*C. alba*, Briss.—*Lug-lug* or *Oojlee*, H. also *Hajee Lug-lug.*—*White Stork.*

The *white Stork* is found, though rarely, throughout India, during the cold weather only, feeding in large flocks on the open dry plains on grasshoppers, beetles, and other land insects, also on lizards and small snakes.

Irides brown; bill, legs and feet red.

314.—*C. leucocephala.*—*Ard. leucocephala*, Auct.—*Cic. umbellata*, Wagler.—*Kalee*, H.—*Manukjor*, in Hindostan.—*White necked Stork.*

This handsome *Stork* is a permanent resident in India, breeding on high trees in the more wooded parts of the country. In its habits it partakes somewhat of both the *Cic. alba*, and *Cic. nigra*, being, though perhaps most generally found about rivers, streams, marshes and tanks, often seen feeding on the open dry plains, or on bare cultivated ground. It feeds alike on fish, frogs, crabs and other aquatic food, and on grasshoppers, beetles, and other land insects.

Irides dark scarlet, surrounded by an external narrow ring of pale yellow; bill black, dark red at the edges and point; naked skin of the face black; legs red. Length 30 to 34 inches; bill at front 6½-7.

315.—*C. nigra*, Auct.—*Soormaee*, H.—*Black Stork.*

This, like the *Oojlee* is also migratory, being only found in the Peninsula during the cold season. It is a rare bird, and generally seen solitary near tanks, rivers, and small streams, feeding on fish, frogs, and various aquatic insects, and their larvæ. A good *Bhyree* will strike it down, and it is eagerly sought after for this purpose.

Orbits naked and red; bill deep red; irides brown; legs brownish red. Length 3½ feet; expansion of wings 6 feet; bill at front 7½ inches; tarsus 8½.

316.—*C. Argala*, Steph.—*Ard. dubia*, Gmel.—*Cic. Marabou*, Temm. —*Adjutant* of Calcutta.

I have but once seen this enormous bird during the early part of the monsoon in the table land near Jaulnah, but did not obtain it.

317.—*C. nudifrons.*—New species?—*Dusta*, H.—*Black-mantled Adjutant.*

Descr.—Plumage above glossy black; the greater coverts pale dusky brown, edged with whitish, beneath pure white. Bill, frontal plate, and occiput, dirty greenish; head, neck and gular bag, reddish pink above, yellowish beneath; head, neck, and as far as the end of the gular bag, covered with strong scattered hairs, or rather hair-like feathers. Irides light greyish brown or grey; feet blackish; forehead, only, naked and horny. Length 4½-5 feet; bill at gape 11½ inches, 2 inches broad beneath at the base; 3 inches high at base; tarsus 11; tibia 15; tail 12; wing about 30; face, throat and lower part of neck with numerous black spots; gular bag when *stretched* about 6 or 7 inches long.

This species is tolerably common in the northern portion of the Dekhan, more especially during the monsoon. It is usually solitary—occasionally in parties of 4 or 5. It descends like the *Vultures* on any carcasses, or stalks about the plains, sometimes close to cantonments, picking up reptiles, insects, and garbage of any description.

318.—*C. calva.*—New species ?—*Chinjara*, H.—*Crab-eating Adjutant.*

Descr.—Above glossy black, with purple and green reflections; the feathers of the back and coverts obsoletely marked with numerous black bars; greater coverts dark brown; tertials and scapulars, bottle green, edged with white; beneath pure white; bill dirty greenish; head perfectly naked and horny. A thick tuft of hairs on the occiput, and a few scattered hairs on the neck. Has no gular pouch. Length 4½ feet; bill 11½ inches; much more slender than in the last. Breadth at base beneath 1½; height at do. 2½; tail nearly 12; tarsus 10; wing 25 inches. I found the stomach of one crammed with crabs, and a few large grasshoppers.

The under tail coverts of the 3 last species are known under the name of *Marabou* feathers, and are highly prized, and much sought after.

Sub Genus MYCTERIA, L.

319.—*M. Australis*, Lath.—*M. Asiatica*, Lath. ?—*Bunarus*, H.—*Large black* and *white Stork.*

This gigantic looking bird is rare in Southern India, being found singly occasionally in tanks and large rivers. It lives on fish, frogs, and various other aquatic animals. Its length of limb gives it the appearance of being a much larger bird than it really is. The young bird has the neck light brown, and very downy, and the colours much less vivid throughout; the irides also dark brown.

Irides yellow; bill black; legs rosy red. Length 4½ feet; expansion about 7 feet; bill 13 inches; tarsus 13½; weight about 11 lbs.

Genus HÆMATOPUS, L.

320.—*H. ostralegus*, L.—*Durya Gujpaon*, H. i. e. *Sea Longshanks* (*Himantopus*).

This bird is included in Mr. Elliot's Catalogue, having been found by him on the western coast, towards the more northern part of the Peninsula, and I have since heard of its having been procured as far to the southward as Mangalore.

Family TANTALIDÆ.—Ibis.

Genus ANASTOMUS.—Ill.—*Open beak.*

321.—*A. typus*, Temm.—*Ard. Coromandelica* and *Ard. Ponticeriana*, Auct.—*Googloo* or *Goonglah*, H.—*Indian Shell Eater.*

This curious bird is tolerably common in those parts of the country where tanks and marshes abound. It lives in flocks of various size or solitary, and feeds on fish, frogs, and various other aquatic animals, but chiefly when procurable, on shell-fish (a species of *Unio*), the breaking of the shell of which to get at the contents, is the cause of the open space or gape between the mandibles, which does not exist in the young birds. Colonel Sykes I see, however, appears to think that the gape exists originally in the young bird, and that it is a provision of nature to effect the opening of the shells, on which it feeds. From my own observations, however, corroborated moreover by Mr. Elliot's, I am inclined to think that the former is the more correct opinion, viz. that the open space is caused by the constant attrition of the mandibles on the hard testaceous covering of the shell-fish. The *Goongloo* frequently perches on trees, and breeds, I am informed, on lofty trees.

Irides bright yellow; bill dark greenish; orbits and pouch, naked and black; legs greenish, with a shade of pink; middle claw, with a sharp edge internally, but not serrated. Length 32 inches; expansion of wings 4½ feet.

This bird flies tolerably rapidly, and with more quickly repeated strokes of its wings than any of the *Heron* family, with which it has generally been placed by systematists.

Genus TANTALUS, L.

322.—*T. leucocephalus*, Lath.—*T. Indicus*, Cuv.—*Dôkh*, H.—*Jaungkul*, in Hindostan.—*Pelican Ibis.*

The *Pelican Ibis* (as it may be named) is common over all India, frequenting rivers, tanks, pools and marshes, generally in parties more or less numerous, and feeding on fish, frogs and aquatic insects, and also according to Sykes, on vegetable matter. It perches freely on trees, and breeds on lofty trees, during the hot weather and monsoon. During the heat of the day, they may be seen standing motionless in the water knee-deep, digesting their morning's meal. They are said to feed a good deal, during the night. The scapulars assume their most beautiful rosy tinge, during the hot weather, or breeding season. The *Bhyree* strikes this bird always on the head, its mandibles being sharp, and inflicting a severe cut.

Irides yellowish brown; bill, naked face and crown, and chin pouch, deep ochre or orange yellow; legs pale dirty pink. Length 3½ feet; expansion of wings about 6 feet; bill (at gape) sometimes nearly 1 foot.

GENUS IBIS.

323.—*I. Macei*, Cuv. and Wagl.—*I. religiosa*, of Sykes' Cat.—*Tant. melanocephalus* of Lath.—the young bird.—*Moonda*, H.—*Suffeid Boozah* of some.—*Black-headed Ibis.*

The Indian *Black-headed Ibis*, is generally supposed to be a different species from the one found in Egypt, and which was held sacred, and embalmed by the ancient Egyptians. Colonel Sykes, however, asserts their identity. This bird is found in tanks, rivers, marshes, wet paddy-fields. &c. in flocks of various size, and feeds on small fish, frogs, crabs, shrimps, and a variety of insects, both water and land, for it is occasionally seen feeding on the dry ground, near rivers and tanks. It is found at all seasons, and therefore most probably, breeds in this country, though I have not yet seen its nest. Inside the bone of the wings is covered by a bright red skin, as in the *Cic. leucocephala.* The young bird has the head and neck partly covered with small white feathers, and is therefore, as Wagler imagines, the *Tant. melanocephalus* of Latham.

Irides lake red; bill, naked head and neck, and feet black. Length 30 to 34 inches; bill at gape about 7; tarsus 4; weight 3½ lbs.

324.—*I. papillosa*, Temm. P. C.—*Boozah*, H.—*Kala Boozah* of some. —*Warty-headed Ibis.*

This bird is of common occurrence throughout India, being found in numerous flocks, feeding on the open plains, chiefly on grasshoppers, beetles, and other land insects, also few even on water insects, frogs, &c. It breeds on trees in the neighbourhood of water, sometimes alone, but at times in numerous parties. Colonel Sykes says correctly " Soar high in the air, uttering melancholy screams." It makes a long flight with a *Bhyree*, and requires a good one to capture it.

Irides light red; bill brownish red; legs dirty brick red; papilla of the crown and occiput, bright red—naked skin on which they are placed black. Length 25 to 30; bill at gape 6; tarsus 3; weight 3¼lb.

325.—*I. falcinellus*, Temm.—*I. igneus*—young bird of the 2d year, according to Wagler.—*Kewaree*, H.—*Glossy Ibis.*

As I have always shot the so called *I. igneus* in company with the other species, I am induced to agree with those who consider it as the young bird of the *I. falcinellus.*

The *Glossy Ibis* frequents shallow water at the edge of tanks and rivers—also marshes and wet paddy-fields. It is always found in flocks, and feeds on frogs, shell-fish, shrimps and various insects, and their larvæ, both aquatic and terrestrial.

Irides brown ; bill and legs dark olive green ; a whitish skin goes round the base of the bill, the eyes and the gape. Length varies from 22 to 26 inches ; of a full grown male, the bill is nearly 6 inches ; and tarsus 4½.

Family RALLIDÆ.—Rails, &c.

Genus PARRA, L.—*Peeho*, H.—*Tank-runner.*

326.—*P. Indica*, Lath.—*P. ænea*, Cuv.—*P. melanchloris*, Vieill.—*P. superciliosa*, Horsf.—*Indian Tank-runner.*

This curious bird is found over most of the Peninsula, in tanks covered with weeds, and water lilies, on the leaves of which it runs with great facility. It feeds chiefly on seeds, and other vegetable matter.

Bill green at the base, yellowish at the tip ; legs dark green. Length about 1 foot ; bill to posterior end of frontal plate 1¾ ; tarsus $2\frac{8}{10}$ths ; centre toe and claw 4½ ; hind do. 4.

327.—*P. Sinensis*, Gmel., Gould. Cent. Him. Birds.—*Golden-necked Tank-runner.*

This handsome species, is perhaps, more generally spread than the last, but not so numerous, except in some few localities. It frequents, like the last, weeded and lily-covered tanks, but is also often to be seen feeding at the edges of rivers and tanks, totally devoid of weeds. Feeds on seeds, also on shells and water bugs.

Irides deep brown ; bill and legs olive green. Length 22 inches ; tail 11½ ; tarsus 2 ; middle toe and claw 3 ; hind do. 2 ; bill at front 1.

Genus PORPHYRIO, Briss.

328.—*P. smaragnotus*, Temm.—*Gall. poliscephala*, Lath.—*Keima*, H. —*Sultana Coot* or *Purple Coot.*

This handsome bird is tolerably common on most of the weedy and grassy tanks, throughout the country, especially when covered with the lotus, walking easily on the leaves, and feeding chiefly on seeds and vegetable matters.

Irides blood red ; bill and frontal plate, cherry red ; legs pale brick red ; wing spur also reddish. Length 18 inches ; bill at gape 1½ ; tarsus $3\frac{8}{10}$; middle toe and claw nearly 5 ; hind do. 2½.

GENUS FULICA, L.—*Coot.*

329.—*F. atra*, L.—*Dasree* or *Dasurnee*, H.—*Bald Coot.*

The *Common Coot* of Europe is a common and abundant bird on most of the Indian tanks, even on those that dry up during the hot months. Lives chiefly on vegetable matters.

Irides blood red ; bill and frontal plate white ; legs green reddish at the sides ; feet leaden coloured. Length nearly 18 inches.

GENUS RALLUS, L.—*Rail.*

330.—*R. Gularis*, Horsf. ?—*R. cærulescens*, Lath. ?—*Blue-throated Rail.*

The species of *Rail*, of which I give a description below, is found in reeds and long grass, by the sides of tanks, rivers and water-courses. I have only seen it in Travancore and Cochin, but it is also enumerated in Mr. Elliot's Catalogue, as found in Dharwar.

Descr.—Crown, top of the head and nape, deep chestnut, diverging into two streaks on the back of neck ; chin white ; cheeks, sides of neck, throat and breast, light leaden ; back, beneath, and wings dark brownish, with a strong olive gloss, and numerous narrow white transverse bars, most numerous on the abdomen and thighs.

Bill sanguineous at the base, and diaphanous, brownish at the tip ; legs brown, with a reddish tinge. Length about 11 inches ; wing $4\frac{3}{10}$; tarsus $1\frac{6}{10}$; bill at front $1\frac{2}{10}$.

331.—*R. rufescens*, Vieill. ?—*R. Philippensis.* ?—*R. striatus.* ?—*R. Ceylonicus.* ?—*Larger brown rail.*

I procured a single specimen of a *Rail* near Cochin, which I cannot refer exactly to any described species, but which appears to approach some of the species named above. I add a brief description : head deep brown ; above olive brown ; the feather edged with pale yellowish rufous ; cheeks and sides of neck fawn ; chin and throat white ; beneath pale fawn, with numerous transverse dark marks ; middle of abdomen white ; shoulder with a tinge of cinereous and edged white. Length 14 inches ; wing 7 ; tarsus 2½ ; tail 3 ; bill at the front, including frontal plate 1½.

GENUS GALLINULA.

332.—*G. akool*, Sykes.—*Indian Water Hen.*

This common bird is found chiefly in reeds and long grass, by the sides of tanks, rivers, and water-courses, and is flushed with difficulty.

I have seen specimens exactly like those described by Sykes, others in which the chin was entirely black,—and others in which there was much white, extending down the middle of the abdomen. These were all from different localities, but most probably, were only different ages of the same bird. There may, however, be several varieties, or it may be distinct species. Length nearly 1 foot; bill at gape 1 inch; tarsus $1\frac{7}{10}$; middle toe and claw nearly 3; hind do. $1\frac{2}{10}$.

333.—*G. Javanica*, Horsf., most probably the same as the *G. phœnicura.*—*Dawuk*, H.—*White-cheeked Gallinule.*

This handsome bird is by no means uncommon in many parts of the country, though seldom seen in some districts. It frequents bushes in the neighbourhood of water or marshy spots—also gardens and hedges in dry ground. Found both solitary, and in parties of 5 and 6. Feeds upon insects of various kinds, both land and water.

Irides red; bill green, whitish at the tip; legs greenish yellow; dusky behind. Length 12 inches; bill at gape $1\frac{1}{2}$; tarsus $2\frac{3}{10}$ths; middle toe and claw $2\frac{3}{4}$; hind do. $1\frac{2}{10}$ths.

FAMILY SCOLOPACIDÆ.—*Snipes and Sand-pipers.*

GENUS SCOLOPAX, L.

SUB GENUS RHYNCHÆA.—CUV.

334.—*R. picta*, Gray, Proc. Zool. Soc.—*R. capensis*, Auct.—*Painted Snipe* of Europeans in India.

The *Painted Snipe* is a permanent resident in India, being found at all seasons in suitable ground, viz. the grassy edges of tanks, marshes, inundated paddy-fields, and the usual haunts of the common snipes. It, however, appears in much greater numbers at the commencement of the cold season, along with the other snipes, so probably the greater number breed towards the more northern part of India. This has, probably, led Colonel Sykes and others to consider it as migratory. I have, however, seen it throughout the hot weather and monsoon in two successive years, and find the same fact stated by Mr. Elliot.

Irides dark brown ; bill dusky reddish ; legs green. Length about 9 inches ; bill 2 ; tarsus 1$\frac{8}{10}$ths.

SUB GENUS SCOLOPAX.

335.—*S. rusticola ?—S. minor ?—S. saturata*, Horsf. ?—*Neilgherry Woodcock.*

I find it impossible from the meagre descriptions of authors, to ascertain whether this bird is identical with the European bird or not, or whether, as some have supposed, it may be the American species, from its smaller size. It appears to correspond in plumage pretty closely with the European bird, but from the examination of a good number of fresh specimens, it seems to be a considerably lighter bird. It arrives on the hills about November ; a stray bird or two being sometimes killed in October, and leaves in March.

Length 15 to 16 inches ; wing 8¼ ; bill at front 3 to 3$\frac{2}{10}$ths ; tarsus 1$\frac{9}{10}$ths ; tail 3¼ ; average weight about 9 or 9½ oz. ; varies from 7 to 11 oz.

336.—*S. nemoricola*, Hodgson, Journ. Asia. Soc. No. 66.—*Solitary Snipe* of the Neilgherries.

This bird differs considerably from the solitary snipe of Europe (*S. major*, L.). It is a rare visitant to the Neilgherries during the cold season, and has not, as far as I am aware, been killed elsewhere in the Peninsula. It frequents the marshy ground at the foot of the dense woods of the hills. I obtained a specimen from J. Scott, Esq. of the M. C. S. which is about 13 inches long, the bill being 2 $\frac{6}{10}$ths.

337.—*S. gallinago*, L.—*Bhuruk* or *Buruk*, H.—*Common Snipe.*

The *Snipe* is found in great numbers all over the Peninsula during the cold season, frequenting grass by the sides of tanks, and streams, marshes, but more especially the inundated paddy-fields.

338.—*S. gallinula*, L.—*Jack Snipe.*

The *Little Jack Snipe* is tolerably abundant along with the last in some parts of the country, especially towards the more northern part of the Peninsula.

SUB GENUS LIMOSA, Briss. and Swains.—*Godwit.*

339.—*L. leucophæa ? ?.*—New species ?—*Chaha*, H.—*Large Godwit.*

This bird, which, in absence of more precise information, I have referred to the European *Godwit*, though strongly suspecting it to be distinct, is a rare visitant to the Peninsula, during the cold weather, and frequents the shallow water at the edge of large tanks. I add a brief description.

Above ashen grey, darkest on the back and rump; beneath white, ashy on the neck, breast and sides; upper tail coverts white, black tipt; tail white at the base, the rest black, with a narrow black tip. Length 20-21 inches; bill 5; tarsus 4; wing 9; tail $3\frac{1}{4}$; bill reddish white, dusky at the tip; legs and feet greenish black.

340.—*L. melanura ?.*—*Chota Chaha*, H.—*Lesser Godwit.*

I have only seen this species on two or three occasions, at the edges of tanks, on the northern part of the table land. As I am by no means certain, that it is the same as the European bird, I also add a description of this one. Plumage above brown; the feathers edged with fawn; head, neck and breast, pale ashy brown; throat white; tail black, white at the base; tail coverts as in the last. Length of one specimen 17 inches; bill 3 $\frac{4}{10}$ths; tarsus $2\frac{1}{2}$; wing 8; tail $2\frac{3}{4}$.

341.—*L. terek*, Horsf.—*S. terek*, Lath.—*Limicola Indiana*, Vieill.

I have only seen this curious bird on one occasion at the edge of the Trichoor lake. Length nearly 9 inches; bill 1 $\frac{8}{10}$; wing 5; tail 2; tarsus $1\frac{1}{10}$ths; bill blackish, green at the base; legs orange.

SUB GENUS TRINGA, L. Swains.

342.—*T. Hardwickii.*—*Limosa Hardwickii*, Gray and Hardw. Ill. Ind. Zool.—*Gehwala*, H.—*Large brown Sand-piper.*

I can find no description of this handsomely plumaged *Sand-piper* in any of the works I possess. It appears, however, to be the same as the species figured in Gray and Hardwicke. It is one of the first that make their appearance here, at the commencement of the cold weather. I have seen them in the middle of September, and as late as the end of March. It frequents the edges of large tanks in numerous flocks. I add here a brief description. Plumage above brown, of various shades of intensity, each of the feathers edged with pale brown, or whitish, or in some with rufous fawn; head and neck paler; face, throat, and plumage beneath white, ashy on the neck and breast. In those specimens killed earliest in the season, the colour of the back is most intense brown, and the feathers are broadly edged with rufous. The neck and head too are tinctured with rufous; tail ashy pale brown, some of the centre feathers barred at the tip with black and white.

Length 12-13 inches; bill $1\frac{3}{10}$; tail 2½; wing 7¼; tarsus 2; legs fleshy, ochrey colour; weight about 6¼ ounces.

343.—*T. Indica.—Tot. Indicus*, Gray and Hardw., Ill. Ind. Zool. ? ?

This very closely resembles the last, and indeed only differs in size, weighing little more than half of the last. As, however, I have found it of the same size throughout all the cold weather, and the species of *Sand-piper* in general are very uniform in size, I have ventured to place it as a distinct species.

Length 9½-10½; wing 6; tail $2\frac{2}{10}$; bill $1\frac{2}{10}$; tarsus $1\frac{6}{10}$; weight about 3½ to 4 ounces.

344.—*T. subarcuata ?*

I have only seen this *Tringa* once or twice, frequenting the sides of tanks in the northern part of the Peninsula.

Length about 8 inches; wing $4\frac{6}{10}$; tail 2; tarsus rather more than 1; bill deep black; legs greenish brown.

345.—*T. pusilla ?.—Chota pun-loha*, H.

I have found this bird all over India, frequenting rivers, sides of tanks, and inundated paddy-fields, in numerous flocks.

Bills and legs black; irides dark brown. Length 6 inches; wing 3 $\frac{8}{10}$ths, a little longer than the tail, which is somewhat above 1½; bill at front $\frac{7}{10}$ths; tarsus $\frac{9}{10}$ths.

346.—*T. Temminckii*, Leister ?

Not nearly so common, I think, as the last species, to which it is closely allied, and has the same habits.

Bill greenish at the base, black at the tip; legs green, with a tinge of reddish. Length 6¼; wing $3\frac{8}{10}$; tail nearly 2; bill $\frac{7}{10}$; tarsus $\frac{7\frac{1}{2}}{10}$ths.

GENUS HIMANTOPUS, Briss. and Swains.

SUB GENUS RECURVIROSTRA, L. *Avoset.*

347.—*R. Avocetta.*—European *Avoset.*

I have only seen this curious bird at the edge of a large tank at the extreme north of the Peninsula, but I have seen stuffed specimens killed as far south as Madras.

Irides red brown; bill black; legs French grey. Length 18 inches; bill $3\frac{3}{10}$; tarsus $3\frac{1}{4}$.

Sub Genus HIMANTOPUS.—*Longshanks.*

348.—*H. melanopterus*, Auct.—*Guj-paong*, H.—*Common Longshanks* or *Stilts.*

Very common all over India, during the cold weather, not leaving till April, frequents rivers, tanks and marshes in numerous flocks. A few couple probably remain here the whole season, as I have seen them as late as June, in pairs on the banks of wooded streams and reedy tanks.

Sub Genus TOTANUS, Sw.—*Sand-piper.*

349.—*T. glottoides*, Vigors, Gould's Century of Himalayan Birds.—*Timtimma* or *Toomtomma*, H.—*Indian Greenshanks.*

Found solitary all over India in rivers, brooks and tanks. Is a wary bird, rising with a very shrill and loud cry—hence its Indian name.

Irides dark brown; bill greenish black; legs pale olive. Length 14; bill $2\frac{2}{10}$ths; wing 7; tarsus $2\frac{1}{2}$; middle toe $1\frac{6}{10}$ths.

350.—*T. Horsfieldii.*—*Limosa Horsfieldii*, Sykes.—*Chota Timtimma* H.—*Lesser Greenshanks.*

This, like the last, is in general found solitary, but much more rare. I have, however, seen it in very large flocks at the Trichoor lake.

Irides dark brown; bill blackish; legs pale olive green. Length 10 inches or $10\frac{1}{2}$; wing $5\frac{1}{2}$; tail $2\frac{1}{4}$; tarsus $2\frac{3}{10}$ths; bill to front $1\frac{6}{10}$ths; weight 3 ounces.

351.—*T. fuscus?*—*Butan*, H.—*Large red-legged Sand-piper.*

Whether this is the species to which I have temporarily referred it or not, can only be determined by actual comparison. I have found this bird very rarely in the Peninsula of India, and only towards the more northern portion of it, by the side of rivers or tanks, and solitary. Specimens killed towards the end of the cold season in April, had assumed the dark summer plumage.

Irides dark brown; bill brown, red at the base beneath; legs orange red. Length 14 inches; wing $6\frac{1}{2}$; tail $2\frac{1}{2}$; bill $2\frac{3}{10}$ths; tarsus $2\frac{3}{10}$ths.

352.—*T. calidris*, Auct.?—*Chota Butan*, H.—*Redshanks.*

As the bird I am now speaking of, is about the same length, and answers nearly to the description of the European *Redshanks*, I have for the present referred it to that bird. I have only obtained a single specimen of this *Sand-piper*, shot at the edge of a tank in the northern part of the table land.

Irides dark brown; bill brown; legs orange red. Length $10\frac{1}{2}$-11 inches; wing 6; tail $2\frac{4}{10}$ths; bill $1\frac{6}{10}$ths; tarsus $1\frac{8}{10}$ths.

353.—*T. glareola*, L.

Found in small parties, or sometimes solitary at the edges of tanks, rivers, brooks and pools of water, common every where. Length 9 inches.

354.—*T. Ochropus.*

Almost always found solitary, occasionally in parties of 3 or 4, in the same localities as the last, and still more common.

Length 10 inches.

355.—*Hypoleucos.*

Found solitary in similar situations with the 2 last species, but not nearly so common.

Length 8 to $8\frac{1}{2}$ inches; wing $4\frac{1}{2}$; tail $2\frac{2}{10}$ths; tarsus 1; bill nearly 1; bill brown, greenish at base beneath; tarsus pale green.

Genus STREPSILAS, Ill.—*Turnstone.*

356.—*S. interpres*, Auct.—*Common Turnstone.*

I obtained a pair of these prettily marked birds at the tank of Jaulnah, 200 miles inland, in the month of April, and have since seen specimens procured as far to the southward as Madras.

Irides dark brown; bill black; legs orange. Length 9 inches; wing 6; tail $2\frac{1}{2}$; tarsus nearly 1 inch; bill at front $\frac{2}{10}$ths.

Genus NUMENIUS, Briss.—*Curlew.*

357.—*N. arquata.*—*Goungh*, H.—*Curlew.*

I obtained a single specimen of the *Curlew* at the edge of a tank, near

Jaulnah. It is enumerated also in Mr. Elliot's Catalogue as found in Dharwar.

358. *N. phæopus.*—*Chota Goungh*, H.—The *Whimbrel.*

I saw the *Whimbrel* in considerable numbers at the Chilka lake, and have also seen it on the sea coast, near Madras, and in various other places. Mr. Elliot says, 'Found every where along the sea-shore, and mouths of large rivers.'

Family CHARADRIADÆ.—*Plovers.*

Genus CHARADRIUS, L.

359.—*C. pluvialis*, L.—*Golden Plover.*

The *Golden Plover* is but rarely met with in the Peninsula. I have only seen it on two or three occasions on the banks of large rivers on the table land, and on grass plains, near the sea coast—usually in small flocks of 5 or 6. I have seen specimens killed in the neighbourhood of Madras, in the breeding plumage viz. with the whole under surface of the body deep black. It therefore, most probably, breeds in this country.

360.—*C. Philippensis*, Lath. ?—*Zirreah*, H. of some.—*Common ringed Plover.*

This pretty little bird is found not only at the sides of rivers, and tanks, but also, and perhaps more generally, in the open dry plains, in flocks of various size, running rapidly along the ground, and picking up various small insects. I have found it all over the Peninsula.

Irides deep brown; bill black; legs yellowish; orbits bright yellow. Length 7¼; wing 4¾; tail 2½; bill at front ½ inch; tarsus nearly 1.

361.—*C. minor*, Wagl. ?—*C. hiaticuloides*, Frankl?—*Lesser ringed Plover*

This species differs but little from the last. It is smaller—has the upper plumage of a darker shade, the quills also much darker, the tertials less lengthened, the lateral tail feather have more white, and the base of the lower mandible is yellow.

I have only found it at the northern part of the table land, at the edge of rivers.

Irides deep brown; bill black, yellow at the base beneath; legs yellow; orbits deep yellow. Length hardly 6½; wing 4; tail 2; bill to front $\frac{4}{10}$; tarsus $\frac{8}{10}$ths.

362.—*C. cantianus.* ?—*C. ruficapillus*, Temm. ?—New species.?

I have found this *plover* at the edge of rivers and tanks, at the northern part of the table land, and also more lately by the side of salt-water inlets, and the sea shore on the east coast, during the hot season in June.

As I am uncertain of its being the European species indicated, I shall give a brief description.

Forehead, eyebrows, face and beneath, pure white; a narrow line from the gape, passing through the eyes and ears, cinereous; a narrow blackish band behind the white forehead; crown of head and nape ferrugineous; plumage above cinereous; external tail feathers pure white; no naked skin round eyes; bill black; legs greenish yellow.

Length 7 inches; wing 4 $\frac{3}{10}$; tail 1 $\frac{8}{10}$; bill at front $\frac{6}{10}$; tarsus rather more than 1 inch.

363.—*C. russatus.*—New species. ?

Descr. Forehead, streak on either side, extending through the eyes, ears, and meeting behind, and a broad pectoral band deep brownish black; top of the head, back and wing coverts of the usual brown cinereous hue of the *Ringed Plovers*; band above the eyes, encircling the head, except in front, and plumage beneath white; wing coverts edged with white; quills and medial tail feathers, dark brown; external tail feathers white, with a brown band which almost disappears on the outermost feather; scapulars deep marroon colour; upper tail coverts, tinged with rufous; bill yellow with black tip; orbits bright yellow; legs orange yellow.

Length 6½ inches; wing 4½; tail 2 $\frac{2}{10}$; bill at front nearly $\frac{6}{10}$ths; tarsus rather more than 1 inch.

I procured a single specimen of this apparently new species of *Ringed Plover* at the edge of the Pulicat lake near Madras, in the month of June. Its distinguishing feature is the marroon colour of the scapulars. Whether this is a permanent mark, or, as I conjecture may be the case, only assumed during the breeding season, I am at present unable to determine.

GENUS VANELLUS.—*Lapwing.*

364.—*V. bilobus.*—*Charadrius bilobus*, Gmel. and Wagler.—*Zirdee*, H.—*Yellow wattled Lapwing.*

This *Plover* is found throughout India, usually frequenting the dry stony plains, or open sandy downs in small flocks, and feeding on various insects. Has a feeble cry, which Colonel Sykes renders as "*Deewit Deewit.*" I found the eggs of this bird on one occasion on a grass plain, on the west coast, in the month of September. They were of a light salmon colour with dusky spots, 4 in number, and laid on a slight depression of the ground.

Irides silvery grey; bill black, yellow at the base; naked skin yellow; legs do. Length nearly 12 inches; wing 8¼; tail 3 $\frac{2}{10}$; tarsus 2 $\frac{4}{10}$; bill to front 1 inch.

365.—*V. Goensis.*—*Tringa Goensis*, Lath.—*Char. atrogularis*, Wagler.—*Teteehree* (vulgo *Teetooree*), H.—*Red wattled Lapwing.*

This well known bird is common throughout most of India, single occasionally, but usually in small parties. It frequents the land in the neighbourhood of water, feeding on various insects, chiefly water ones, shells, &c. It has a loud shrill cry, something like '*Did he do it,*' or as others say '*Pity to do it.*' This call is much heard at night, even in places where none were seen during the day. It is often very annoying to sportsmen, hovering over him, and uttering its shrill cries for some distance.

The *Teteehree* is said by the natives to sleep with its legs upwards, and the Indian proverb '*Teteehree se asman thama jaega,*' or can the *Teteehree* support the Heavens? is applied to a person who undertakes something far above his strength.

Irides red; bill at the base and fleshy skin, lake red; tip of bill black; legs yellow. Length nearly 13 inches.

366.—*V. ventralis.*—*Charad. ventralis*, Gray and Hardw., Ill. Ind. Zool.—*C. coronatus*, Vieill. ?

I obtained a single specimen of a bird which appears to be the young or female of the one figured in Gray and Hardwicke, at the edge of a large tank near Jaulnah. It answers the description too (with the exception of the black spot on the abdomen) of *Wagler's C. ventralis*, but that bird is described among the 3-toed *Charadrii.* My bird has a hinder toe, though a very small one.

This bird is evidently a link joining the *Vanelli* to the *Œdicnemi*, its bill being larger and more robust than that of most *Vanelli.*

Irides dark brown; bill and legs black. Length 13 inches; wing 8½; tail 3½; tarsus $2\frac{3}{10}$; bill to front $1\frac{2}{10}$ths.

GENUS ŒDICNEMUS, CUV.

367.—*Œ. crepitans*, Temm.—*Char. Œdicnemus*, L.—*Burseree* or *Kurwanuk*, H.—also sometimes *Lumbee.*—*Bastard Florikin* of English.

The *Thick-kneed-plover* of Europe is found all over the Peninsula, and remains the whole year. It frequents the open stony plains—also bushy tracts, and open spaces in jungly districts. Found in pairs, or in small parties. When approached, it often conceals itself behind a bush or stone, and sometimes squats close to the ground, and is with difficulty seen. It feeds on various insects chiefly, also sometimes on seeds of various kinds. It wanders much at night, and has a peculiar long shrill piping note ; seldom heard except at this time—its usual cry, being a single harsh creaking note. The *Shikra* (*Accipiter Dukhunensis*) is often flown at this bird. Its flesh is of excellent flavour, and much esteemed by some.

Irides pale greenish yellow; legs pale olive. Length 16-17 inches; wing 9 ; tail $4\frac{1}{2}$; tarsus $3\frac{4}{10}$; bill at front $1\frac{1}{2}$; weight about 12 to 13 oz.

368.—*Œ. recurvirostris*, Swains., Lardn. Cycl.—*Aubee*, H.

This curious bird which has been lately accurately described by Swainson, is by no means common, and is only found by the sides of the larger rivers, and tanks, and salt-water inlets, in pairs, sometimes two or three pairs together. It feeds on various aquatic insects and their larvæ. Its cry of alarm is a loud harsh creaking note, and like the last species, it occasionally squats, when approached.

Irides pale yellow ; bill black, yellow at base ; legs yellowish green. Length 20 inches ; wing 11 ; tail $4\frac{1}{2}$; bill to front $2\frac{6}{10}$ths ; tarsus $3\frac{1}{4}$.

GENUS TACHYDROMUS, Ill.

SUB GENUS GLAREOLA, L.—*Swallow Plover.*

369.—*G. Orientalis*, Leach.—*Lesser* or *square-tailed Swallow Plover.*

This neatly plumaged little bird is rare in most parts of Southern India. I have seen it occasionally in pairs, by the sides of tanks, running briskly along the edge, and picking up various small insects. I on one occasion saw a large flock of them, apparently migrating from one district to another, it was in the month of September, and near the extreme south of the Peninsula.

Irides dark brown; bill black; gape dark red; legs black. Length 7$\frac{1}{4}$ inches; wing beyond tail 1$\frac{6}{10}$ths; from base 6; bill at front $\frac{4}{10}$ths; tarsus $\frac{9}{10}$ths.

370.—*G. torquata*, Temm.—***Fork-tailed Swallow Plover.***

I have seen this bird but very rarely in small flocks, or pairs, by the edges of tanks or rivers, feeding chiefly like the last, on various aquatic insects and larvæ, especially on *Nepæ*. On one occasion, I saw a numerous flock of them flying low over some grain fields, apparently capturing insects on the wing. Its flight is remarkably swift, and swallow-like, as is that of the last species.

Irides dark brown; bill and legs black; the posterior portion of the gape red. Length 11 inches, of which the tail is 4$\frac{3}{4}$; wing 7$\frac{1}{2}$; bill at front $\frac{1}{2}$ inch; at gape nearly 1 inch; tarsus 1 $\frac{3}{10}$ths.

SUB GENUS TACHYDROMUS, Ill.—Cursorius, Lath.—*Courier Plover.*

371.—*T. Asiaticus.*—*Char. Coromandelicus*, L.—*Nookree*, H.—*Indian Courier Plover.*

The *Courier* is very numerous towards the more northern part of the table land, much less so towards the south. It frequents the open bare plains only, in numerous flocks, running along with great celerity, and picking up various insects, beetles and small grasshoppers and their larvæ. It breeds in the more retired spot during the hot weather, laying 3 eggs of a pale greenish yellow colour, much blotched, and spotted with black, and also with a few olive spots. They are deposited in a slight hollow.

Irides deep brown; bill black; legs creamy white, as if coated with paint. Length varies from 8$\frac{1}{2}$ to nearly 10 inches; wing 6; tail 2$\frac{3}{10}$; bill at front $\frac{8}{10}$; tarsus 2$\frac{2}{10}$. As I have frequently killed birds of various length from the same flock, I fancy that Swainson's supposed new species *T. Orientalis*, said to differ only in size from the *T. Asiaticus* of authors, must be abandoned.

SUB GENUS AMMOPTILA, Sw.

372.—*A. charadroides*, Sw. ?—*Sand Plover.*

A bird of this remarkable genus is mentioned in Mr. Elliot's Catalogue, but without any description, so I am uncertain if it is the same species as the one indicated by Swainson, in his Synopsis. Mr. E. mentions his having found it in flocks on the sea-shore, on the west coast of India.

Bill black ; legs and feet plumbeous. Length 15 inches.

ORD. NATATORES.—*Swimmers.*

FAMILY ANATIDÆ.—*Ducks.*

SUB FAMILY PHÆNICOPTINÆ,—SW.

GENUS PHÆNICOPTERUS.—L.

373.—*P. Europæus.*—*P. ruber*, L.—*Bug Huns*, H.—*Rajah Huns* of some.—*Flamingo.*

The *Flamingo* is found throughout the Peninsula, in large rivers and tanks, though not a very common bird. I saw it in the greatest abundance in the large Chilka lake, on the low flat islands of which I have seen many hundreds congregated together. It feeds on vegetable matter, and minute water insects, &c. and much gravel is in general found in its stomach. It is tamed, and kept at Hydrabad by some of the nobles of that city, and fed on grain of various kinds. I think Swainson is perfectly justified in placing this bird among the ducks, from its external structure alone, and I see that its internal anatomy fully confirms this view. In fact the natives of India recognize its alliance with this family, by calling it *Heron Goose* or *King Goose.*

Bill pink, black at the tip ; legs pale rose coloured ; irides pale golden yellow. Length 3½ to 4 feet.

374.—*P. minor.*—*Lesser Flamingo.*

I have seen a flock of this bird at the Jaulnah tank, last cold season, and am informed by Shikarees, that it pays an annual visit here, about Christmas.

SUB FAMILY ANSERINÆ.

GENUS ANSER, *Antiq.*

375.—*A. Indicus*, Lath., Gould Cent. Him. Birds.—Indian or *Barred-headed Goose.*

This *Goose* is not so common in Southern India, as it appears to be in Bengal, and the more northern Provinces. I have seen it in pairs in August, within a few miles of Cape Comorin, and once or twice in flocks of 15 or 20 in large tanks, on the central table land.

GENUS DENDROCYGNA, Sw.—*Tree Ducks.*

376.—*D. Awsuree.*—*Mareca Awsuree*, Sykes' Cat.—***Anas arcuata***, Horsf. Java.—*Sillee*, H.—*Whistling Teal* of Europeans.

As my specimens agree exactly with the description of Sykes, of his *M. Awsuree*, and also the description in Mr Elliot's Catalogue, I think it may be considered distinct from the Javanese bird. It is found in numerous flocks, in various parts of the country, most abundant, perhaps, in the wooded districts, frequenting tanks, and often seen perched on the boughs of trees that overhang the water. I have not seen its breeding places.

Length about 18 inches; bill to front 1½; tarsus 1 6/10; centre toe and claw 2¾; wing 8; tail 2½; bill and legs plumbeous; irides brown; eyelids, bright yellow. It is not esteemed good eating.

377.—*D. major.*—New species ?—*Large Whistling Teal.*

I am strongly inclined to consider this as a distinct species from the last. It differs in its larger size, in the whole head, neck and under parts, being rufous or chestnut, and not so dark in the belly as the former bird. The upper tail coverts are yellowish white, instead of deep chestnut. There is a blackish line down the back of the neck from the nape. The tip of the head is deep chestnut instead of brown, and there is a broad patch round the centre of the neck, in which the feathers are somewhat hackled or lanceolate, whitish at the tip, and blackish at the base. The feathers of the loins are highly elongated, chestnut on one side of the shaft, and creamy white on the other side, broadly edged with dusky.

Length 20-21 inches; wing 9¼; tail 2 ¼ inches; tarsus 2; bill at front 1 9/10 ths; centre toe and claw 3½.

378.—*D. ? girra.*—*Anas girra*, Gray and Hardw., Ill. Ind. Zool.—*A. Coromandelica.*—*Geerjah*, H.—*Cotton Teal* of Europeans in India.

This pretty little bird is not very common in Southern India, and like the last, abounds most in the more wooded districts, and it is said to breed in some of the forests of the western coast. It has a peculiar changing note, not unlike that of the *Grouse*, which it generally keeps up whilst flying. It is found both in pairs and flocks—sexes alike.

Irides bright crimson; bill black; legs greenish ochrey yellow, blackish in some. Length 13 inches; weight 9 ounces.

This bird, by its bill, appears to approach the *Dendronessa* of Swainson.

378. bis.—*D. affinis.*—New species ?—*Girree*, H.

This species or variety, is mentioned in Mr. Elliot's notes as differing from the last in the permanent want of the collar in both sexes and at all ages.

Length nearly 14 inches.

GENUS PLECTROPTERUS, Leach.

379.—*Pl. melanotos*, Steph.—*Anas Melanotos*, Gmel.—*Nooktah*, H. also of the Mahrattahs.—*Bronze-backed Goose.*—*Comb-Duck*, (Sykes) of the Residents in the Madras Presidency.

This splendid bird is found all over India, in tanks and rivers, though not very abundant. It breeds during the monsoon in most of the wooded districts, and as I am informed, in long grass, near rivers or tanks. The female is much less than the male, and wants the large protuberance at the base of the bill. It feeds on various seeds and vegetable matters—also on paddy, jowaree, and other grains. The flesh is hard, and not held in much esteem. Length of male 34 inches; wing 16; tarsus 3; bill straight to gape 2¾: height of protuberance above 2 inches, from the edge of the mandible, length of do. at the centre nearly 2. Female from 26 to 28 inches long.

Irides dark brown; bill and protuberance black; legs greenish plumbeous; weight nearly 6-lb.

SUB FAMILY ANATINÆ, Sw.—*River Ducks.*

GENUS MARECA, Leach.—*Widgeon.*

380.—*M. fistularis*, Steph.—*Anas Penelope*, L.—*Common Widgeon.*

Common in the cold weather throughout India in the rivers and tanks, found in large flocks.

Irides dark brown; bill light plumbeous, black at the tip.

GENUS ANAS, L.

SUB GENUS CHAULIODUS, Sw.

381.—*C. strepera*, Sw.—*Anas strepera*, L.—The *Gadwall.*

Not so numerous as the last, but by no means rare—only found in the cold season.

Irides brown ; bill blackish, reddish at the sides and lower mandible ; legs and feet ochrey yellow.

SUB GENUS ANAS.

382.—*A. clypeata*, L.—*Treduree*, H.—*Shoveler.*

Common over all India, in flocks during the cold weather.

Irides yellow ; bill black ; legs orange ; bill of female brown, reddish beneath.

SUB GENUS BOSCHAS, Sw.

383.—*B. circia.*—*A. circia*, L.—*Garganey Teal.*

Common throughout the cold weather, being one of the first to arrive in the country, sometimes before the end of September.

Irides brown ; bill black ; legs greenish plumbeous.

384.—*B. crecca*, Sw.—*A. crecca*, L.—*Common Teal.*

Common along with the last.

SUB GENUS DAFILA, Leach.

385.—*D. caudacuta.*

Tolerably abundant towards the more northern parts of the Peninsula, rare in the south, found in large flocks.

Bill plumbeous, with a black line down the centre, also at edges ; legs plumbeous.

Irides dark brown.

GENUS TADOMA, Leach.

386.—*T. rutila*, Steph.—*A. casarca*, L.—*Soorkhab*, H.—also *Chukwa.* —*Ruddy Shieldrake.*—*Brahminy Duck* of Europeans.

This large duck is, like the last one, less common towards the south, than in the more northern parts of the Peninsula. Is frequently seen in pairs, or small parties of 4, 5 or 6, but occasionally, as in the Chilka lake, in numerous flocks of some hundreds. Only found, as far as I can learn, in the Peninsula, during the cold weather. Colonel Sykes, however, appears to think that they are resident in India, throughout the whole year. Found much on rivers. Mr. Elliot in his notes says "Found in pairs. often several pairs together, shy, uttering a peculiar deep note which has a strong resemblance to deeply intonated *ā-oung*." The Hindoos consider them the models of conjugal tenderness. The flesh is held in no esteem in this country.

Irides dark brown ; bill and legs black.

387.—*T. ? pæcilorhyncha.*—*A. pæcilorhyncha*, Gmel.—*Gurm-pace*, H. *Spotted-billed Duck.*—*Large Grey Duck.*

This fine duck is most common in the more wooded parts of the country, and is a permanent resident, breeding in retired places and marshy spots, among the jungles, during the hot weather.

Irides brown ; bill black, yellow at the tip, red at the base ; legs deep red. Length 2 feet to 26 inches ; tarsus 2¼ ; weight about 3-lbs. Is excellent eating. I am by no means certain, that it is a true *Tadomer*, being perhaps a species of *Boschas*, or *Chauliodus* ; but the elevation of the bill at the base, has induced me to consider it as a *Tadomer*. I on one occasion found a couple of small fish in the gizzard of this *Duck*, besides vegetable matter and gravel.

368.—*T. ? cayophyllacea.*—*Pink-headed Duck*, Lath.

Though I have not yet seen this *Duck*, I venture to include it in my present Catalogue, from the concurrent testimony of several Shikarees, who described it, so as to leave no doubt in my mind of its being the species named as above. It is said to be an occasional, though very rare visitor to the rivers and tanks of the country, about Jaulnah, during the cold weather only.

SUB FAMILY FULIGULINÆ, Sw.

GENUS FULIGULA.

389.—*F. rufina*, Stephens.—*Red-headed Pochard.*

Not very common in the Peninsula, generally in small parties in the cold weather.

Irides deep yellow.

390.—*F. cristata*, Steph.—*A. fuligula*, L.—***Tufted Duck.***

Tolerably common throughout the Peninsula, during the cold weather. It is one of the latest to quit the country, and I have on one occasion found a single one in the month of June, in a tank near Hydrabad.

Irides bright yellow; bill plumbeous; legs blackish. Length 19-20 inches.

391.—*F. nyroca.*—*A. leucophthalmos.*—*Bechstein.*

Rare in the Peninsula, generally in pairs, or very small parties in tanks. Irides greyish white. These 3 last species dive remarkably well.

FAMILY COLYENBIDÆ.—*Grebes.*

GENUS PODICEPS, Lath.

392.—*P. Philippensis*, Steph.—*Choorakah*, H. ?—***Indian bay-necked Grebe.***

Common in the tanks all over India, even in those which dry up early in the season. Feed on various water insects, &c.

Irides ochrey yellow. Length 9½ inches.

392, *bis.*—*P.* ——— ?—*Lesser Grebe.*—*Pun-doobee*, H. ?

I have hitherto not procured this little species of *Diver*, which is mentioned in Mr. Elliot's Catalogue, though without any description, but I have seen it on several occasions, in grassy tanks, and among weeds. It appears much smaller than the common one.

FAMILY PELECANIDÆ.

GENUS PLOTUS, L.—*Darter.*

393.—*P. melanogaster*, Gmel.—*Banwah*, H.—*Darter* or *Snake bird.*

Not very uncommon in the Northern Circars, and in other districts where tanks abound. Feeds on fish chiefly, swims and dives with great rapidity, and as Colonel Sykes remarks, has the faculty of being enabled to swim with the whole of its body under water, the long head and neck being alone visible, looking like a snake.

Length about 3 feet; tail 9½; bill front $3\frac{3}{10}$ths.

GENUS CARBO, Mayer and Swains.—*Cormorant.*

394.—*C. Javanicus*, Horsf.—*Phal. Africanus*?—*Joghrabee*, H.—vulgo *Pun-kowa*—i. e. *Water crow.*

Very common in all the tanks and rivers of India. Feeds on fish, and is very voracious.

Irides crimson; bill black, reddish at base beneath; legs black.

I may state that I have specimens, shot in company with many others of the same plumage, which have the wing coverts and scapulars blue grey, margined with black, and in the belly and neck, having much white in their plumage, mixed with dusky blackish.

Length 23; tail 6 inches; bill at front 1 $\frac{1}{10}$th.

395.—*C. Cormoranus.*—*Pelicanus Carbo*, L.—*Gho-ghur*, H.

This is much more rare than the last. I have only seen it on the wooded Bhowany river, at the foot of the Neilgherries, and once or twice in the northern part of the table land, in large tanks. I have seen it in the month of June, as far inland as Hydrabad, so it most probably remains here the whole year and breeds. Mr. Elliot mentions it in his Catalogue, and I learn from him that it is far from being uncommon in parts of the Southern Mahratta Country, and that it may sometimes be seen in considerable numbers, sitting on trees in the neighbourhood of tanks.

Length 2 feet 10 inches; bill at front 2¼; weight 4½ lbs.

GENUS PELICANUS, L.

396.—*P. onocrotalus*, L.—*Hawaseel*, H.—The *Pelican.*

The *Pelican* is tolerably common in many of the tanks all over the country, even very far inland, occasionally perches on lofty trees.

SUB FAMILY LARIDÆ.—*Gulls* and *Terns.*

GENUS STERNA, Swains.

SUB GENUS STERNA, L.—*Sea Swallow*, or *Tern.*—*Kaghuzee*, H.

397.—*S. melanogaster*, Temm.—*S. acuticauda*, Gray and Hardw., Ind. Zool.

This *Tern* I have found all over the country, frequenting tanks, and more especially rivers.

398.—*S. similis*, Gray and Hardwicke, Ill. Ind. Zool.

Found in the same localities as the last, and still more common and numerous.

Length 11½ inches; wing 9¼; tail 3 $\frac{1}{10}$th; bill at front 1 $\frac{1}{10}$th: tarsus $\frac{9}{10}$th; bill dark lake colour; feet and legs black.

399.—*S. Seena*, Sykes.

Spread throughout all the Peninsula, but less common than the last.

Bill bright yellow; legs red. Length 17 inches; wing 11; tail 8½; bill at front 1½.

400.—*S. anglica*, Montagu.—*Marsh Tern.*

Common all over the country.

Length about 16 inches; but it varies a good deal in size: of one 16 inches long, the wing is 13½, 2½ inches beyond the tail, which from base is nearly 6; bill and tarsus black.

401.—*S. minuta*, L.

I have seen this pretty little *Tern* most abundant in the west coast, at the mouths of rivers, but have also met it above 200 miles inland.

Length nearly 9 inches; wing 6½; half an inch beyond the tail, which is nearly 3; bill at front 1 $\frac{2}{10}$; yellow, dusky at the tip; legs orange; tarsus $\frac{7}{10}$ths.

402.—*S.* ——— .—New species?

Descr. Head and back of neck sub-crested deep glossy black, plumage above light grey; beneath white; tail much forked; lateral feathers white; bill yellow; legs black.

Length 17½; wings 12½; 1 inch beyond tail; tail 6½; bill (at front) 2 $\frac{3}{10}$ths; tarsus 1 inch.

I have only found this very elegant species on the sea coast, on the west of India, at the mouths of rivers.

403.—*S.* ———.—New species?

Back, wings and tail pale grey; rest of body white, except a blackish grey streak through the eye; head and neck with a tinge of grey.

Length 14½ inches; wing 11; tail 4; bill at front 1 $\frac{1}{10}$th; tarsus 1½ bill black, within orange red; legs and feet dusky sienna reddish.

This species appears tolerably common on the east coast of the Peninsula, near Madras.

404.—*S.* ———.—New species.

Descr.—Head and nape blackish ; feathers edged with white ; body above grey, beneath white ; bill deep lake red ; legs sienna.

Length 11 inches ; wing 8½ ; tail 3 ; bill at front 1 inch.

GENUS THALASSITES, Swains.

405.—*T.* ———.—New species ?

Descr.—Head and upper part of the neck glossy black, above light grey ; beneath, and tail white ; bill orange red ; legs black.

Length 21 inches ; wing 16, reaching 3 inches beyond the tail, which is 5½ ; bill at front 2 $\frac{6}{10}$th ; tarsus 1 $\frac{3}{10}$th.

I have found this large *Tern* most abundant on the west coast of India, at the mouths of rivers, but also far inland, frequenting tanks. The young bird differs in the head being spotted white and black, instead of being pure black.

GENUS LARUS, L.—*Gull.*

406.—*L. brunnicephalus ?*.—New species ?.—*Brown-headed Gull.*

Descr.—Hood pale ashy brown, terminated by a darker edge ; mantle and wings light grey ; the rest of the body pure white ; bill and legs deep lake red ; a half circle of white feathers round the back part of the eye.

Length 19 inches ; wing 14 ; tail nearly 6 ; bill at front 1½ ; tarsus 2.

I have found this *Gull* common on the west coast of India, and also inland above 200 miles, frequenting rivers and tanks. A *Gull* which corresponds exactly in size with this one, and which I have usually seen in company with it is probably the young bird. It differs in wanting the brown hood, and in the tail being broadly tipped with black.

407.—*L.* ———.—New species ?

I possess only a young specimen of this *Gull* in the usual mottled plumage, so shall content myself with giving its measurements. It was shot 200 miles inland.

Length 2 feet ; wing 18 inches ; tail 8 ; bill (front) 1 $\frac{3}{16}$th ; tarsus 2 $\frac{6}{16}$th ; bill and legs yellowish.

I have seen other species of *Gull* on the sea coast, but not having procured specimens, refrain from noticing them at present.

I have now brought to a conclusion this imperfect Catalogue, the chief object of which has been an enumeration of all the birds found in Southern India; the few brief notes I have added having been hastily drawn up, without method, to relieve the monotony of a bare list of names. I purpose in a future, and I hope, an early number, to add a supplement, containing the description of a few additional species I have obtained since the first parts of the Catalogue were printed—and also to correct several errors of nomenclature, and to add some brief additional notes on the habits and geographical distribution of a few of the species, which more recent and extended observations have enabled me to offer.

The specimens on which my Catalogue was founded, are now on their way home to a distinguished Ornithologist, and as soon as they are examined, and identified by him, I will in another supplement give the result of his examination, and a synopsis of all the species with their correct names and synonymes. By way of rendering this part more generally useful, I may probably also add a synopsis of the different genera found in India, and a brief description of all the species, so that it may serve as a text book for the Peninsular birds, and supply to the ornithologist in this country, the want of the numerous bulky and ill-compiled works of reference, which often perplex as much as they inform.

I trust also to be able to add to this, through the kindness of Walter Elliot, Esq., a list of the names of many of the birds in several of the native languages, and in the native characters, by which collectors may be much facilitated occasionally, both in the acquisition and identification of various species. At a future period, I hope that my observations on the habits and manners of many of the Indian birds may be so far extended as to enable me to publish a much more full and enlarged account than I am now able to attempt, and illustrated by coloured figures of many of the unfigured species. To enable me, however, to effect this, I look confidently for the assistance and co-operation of other observers, without which it will be impossible to present any thing like a tolerably complete history of Indian Ornithology; for, from the nature of a tropical climate precluding much or constant exercise on the open air, and the necessary occupations of most of the residents here, no one individual can ever expect to give from his own observations a faithful transcript of the habits and manners of even a limited number of the birds; and it is only from a series of detached observations, and from many individuals co-operating together, that such a much wished for result can be obtained.

With this view, I earnestly solicit any of the readers of this Catalogue, (who may have the opportunity and inclination), to forward me any observations they may make, and let them not deem the smallest scrap of information too trifling to send. I would more particularly request further intelligence regarding the nidification of the Indian birds, of which so little is known, their various notes, food, and manner of feeding, times of appearance and disappearance of migratory species, names in any of the native languages, and any tales, proverbs or superstitious ideas the natives may have concerning them. There are also a few desiderata which I shall here enumerate, and any individuals who may have it in their power to give any information regarding them, will receive my best thanks.

No 6.—Specimen of the large *Fishing Eagle* of the Chilka lake, which I suspect may be the *Hal. ichthyætus*, No. 8 of the Cat.

No. 34.—Specimen and descriptions of the *Besra*.

Specimen and description of the *Kandesrah* of Indian Falconry, a species of *Sparrow-hawk*, I suspect, nearly allied to the *Besra*.

Specimen or description of the *Gorbesrah* which I suspect is the same as my No. 36, a species of *Goshawk*, differing in its smaller size from the *Baz* or true *Goshawk*.

No. 268. *bis*.—Whether the *Ortygis Taigoor*, of Sykes, is a distinct species, or the young bird of the *O. pugnax*.

No. 282.—Any information regarding the *Black Florikin*, its time of appearance in different districts, at what season it is seen in a state of change, &c. &c. &c.

II.—*On the General Application of Low Steam Power to all Vessels, instead of Sails.*

It is very surprising that though so much has been done in applying Steam Power to move vessels at high speeds for the conveyance of passengers, it does not appear that as yet, any considerable trials have been made of it, for the conveyance of merchandize at moderate rates. The quantity of fuel and power of engine requisite to propel a ship at high speeds is so great, that for a voyage of any considerable length, the vessel is almost taken up with them, leaving so little room for merchandize that it will not answer, except principally employed in the transport of passengers. But this is no reason that it should not answer to use steam for the transport of merchandize at low rates, and the subject is well worthy of investigation. The question is, whether merchandise can be transported at the *rate* it is at present conveyed by sailing vessels, cheaper or safer by steam; or whether it can be conveyed at the same *cost* as in sailing vessels, but quicker by steam.

It seems strange to conclude, that, because it will not answer to use steam for the common purposes of commerce at high speeds, therefore it will not be advisable to use it at moderate rates. On land, horses are used at high speeds for passengers, and at low rates for goods, and on examination it may be found to be just the same with Steam Power at sea. The two cases are in effect precisely similar; in moving land conveyances the resistance at higher speeds does not increase, but animal power rapidly diminishes, which is the cause of the rapid increase of cost. In steam vessels, there is indeed no less of power at higher speeds, but the resistance to a vessel moving through the water rapidly increases, and hence the effect is the same as in land conveyance; viz. a rapid increase of expence. In the one case, there is no increase of resistance, but a decrease of power as the speed increases; in the other there is no decrease of power, but there is an increase of resistance. Hence upon the first glance at the subject, it would appear probable that as it is found to answer on shore to use horses for passengers at high speeds and for goods at low ones, so it may be found in the case of steam afloat.

The best way of attempting to arrive at a sound conclusion in this case, is, to compare the actual cost of the two modes from the data we have, and then to consider what further important points there are in the matter, which it is not so easy to make subjects of calculation.

But it may be well first to consider the leading principles, which affect the motion of vessels through water. It is well ascertained that up to about 8 knots, an hour, the resistance of water to vessels increases more rapidly than in the proportion of the square of the velocity; that is, with a double velocity resistance is more than four times as great, with a treble velocity more than 9 times as great and so on. Hence to move a vessel a certain distance, it takes more than four times as much fuel and more than four times the power of engine to do it at a double speed, and more than 9 times as much fuel and steam power, to do it at three times the rate. This appears to hold good up to a certain speed, about 8 knots an hour, after that the resistance does not increase quite so rapidly, but still in rather a greater proportion than the velocity. Hence if a vessel can carry sufficient fuel to go 4000 miles at the rate of ten knots she can carry enough to go about 12,000 at 5 knots, and more than 50,000 miles at 2½ knots. But further, as in going at the double speed the engine must not only overcome more than a proportional resistance, but also do it in half the time, the actual power of engine employed for 10 knots speed must in fact be about 6 times the power of that required for 5 knots or about 10 times, what is necessary for 4 knots, though it will only be in action half and two-fifths the time respectively, in accomplishing the same distance.

Hence if a vessel of 400 tons required at 10 knots an hour an engine of 180 horse power, and 50 tons of coal per 1000 miles, she would at 5 knots an hour require an engine of 30 horse power, and 8½ tons of coal for that distance; and at 4 knots, an engine of 18 horse power and 5 tons of coal for the same. This has been proved by experiments in many ways, to be about the proportionate power required for the speed.

And with respect to the effect of the size of the vessel, it is also well known that the resistance to a large vessel is less in proportion than to a small one, that is, if a vessel for instance of 1600 tons, required an engine of 400 horse power for any given speed, or one horse power to every 4 tons, a vessel of ⅛ that size, or 200 tons, would require double that proportion, or 100 horse power, being 1 horse power to every 2 tons; the cause of this is obvious, that the body of water to be removed by any vessel is in proportion to the breadth and depth multiplied together, but her capacity is in proportion to the breadth, depth and length multiplied together. Thus a vessel of double dimensions will displace four times as much water in moving, and consequently meet with four times the resistance, but her capacity will be increased 8 fold, so that while she carries 8 times as much cargo, she only meets with 4 times as much resistance, and consequently requires in proportion to her tonnage, only half as much power. It is on this ground, that large vessels are found to answer better as steamers than small ones, and it was because this principle was forgotten, that it was so confidently asserted, that in the present state of the knowledge of steam navigation, a vessel could not carry fuel enough to cross the Atlantic, the calculations being made from small vessels without allowing for this consequence of an increased size.

Hence we find that in steam navigation, the same vessel requires for a double speed more than double the quantity of fuel, and about six times as powerful an engine to *go a certain distance.* The same vessel to go *for a certain time* at a double speed, requires about six times the quantity of fuel, and six times the power of engine, but she will go in that time double the distance. For a given speed, a vessel of eight times the tonnage as another, will only require four times as much fuel, and four times as great a power of engine.

These points are so well known and have been so often ascertained practically, that it is not necessary to attempt the proof of them here.

The point that remains is simply to estimate from these principles and from the known cost of the various items in sailing and steaming, which would be cheapest at different rates of speed, to work a vessel by sails or by steam.

For this purpose the actual cost of working a vessel of 380 tons, new measurement, in the Indian seas for near two years may be taken, as a subject for comparison.

EXPENCES OF A SAILING VESSEL.

First class vessel of 380 tons new measurement, above an average sailer, and working well, carrying 400 tons of a mixed cargo.

COST.

Hull	3600 £
Fitting for sea in every respect	2400
Total cost	6000 £

EXPENCES.

	£
Insurance at 6 per cent	360
Commander	360
1st Officer	120
2d do.	72
4 Sucunnies (helmsmen)	120
Syrang and 2 tindals	66
China carpenter	48
Butler and boy	24
28 Lascars	336
Victualling 38 persons	47
Renewing sails	80
Do. spars	40
Repairing hull, 2½ per cent. (*including coppering*)	90
Sundries, paint, &c	50
Port charges	200
Replacing hull, 3 per cent	108
Steam tug hire	30
Total expences per annum	2151 £

The actual distance run by above vessel measuring the nearest line from port to port was 26,500 miles, in 23 months, or 13,800 miles per annum; and the number of days actually under way was 303, giving 88 miles distance per day, or 3¾ knots per hour, for the average of a good sailing vessel in the Indian seas, allowing only the real distance between the ports, which is done in order to compare her distances with those of a steamer.

EXPENCE OF STEAMING.

Vessel of the same capacity, viz. measuring 380 tons, and capable of carrying 400 tons of a mixed cargo, but built of course upon the model of a steam vessel, that is with greater length and less draught of water, propelled by a 30 horse engine.

COST.

	£
Hull	3,400
30 Horse engine, &c.	1,200
Anchors and cables	200
Set of lug sails and moveable masts, in case of accidents	200
Total cost	5,200£

Expences.	£
Insurance at 4½ per cent	234
Commander	360
Officer	120
Engineer	300
2d Do.	120
Armourer	120
6 Stokers	72
1 Syrang, 1 tindal, 10 lascars	168
China carpenter	48
Butler and boy	24
Hired labour in port in consequence of the small crew	100
Victualling 21 persons	24
Repairing hull 2 per cent	108
Renewing engine 9 per cent	108
Repairs of engine 5 per cent	60
Oil	12

Steaming 15,100 miles at 108 per day, at 8-lbs of coals per horse

power, per hour, 350 tons at 16 shillings.............	280
Total expence per annum.	2380
Deduct an account of 800£ less capital than in the case of the sailing vessel, int. at 4 per cent..	32
Total expense of steaming 15,100 miles.......	2348
Do. of 13,800 miles, the distance run by the sailing vessel in a year.	2150 £
Expenses of sailing vessel same distance.	2150 £

That is by the above estimate, the expences of working the vessel by steam and by sails is precisely the same. It remains to calculate the loss of tonnage and consequently of freight that would be the consequence of carrying the engine and fuel.

The average length of voyage made by the above vessel was 1800 miles each ; supposing the steamer to carry on an average, coal for 2400 miles, or 23 days, she would require, of coals.... .... 58 tons.*

Weight of engine........	20 tons.
Total..........	78
But as she would require scarcely any space for sails, and the various stores of a sailing ship, we may deduct on that account, especially as her upper deck will be quite clear............	40
Actual loss of feight caused by engine.........	38 tons.

Further, as the sailing vessel would not be full every voyage, but probably be at least 38 tons deficient in an average of her voyages, the steamer would in effect suffer no loss compared with the sailing vessel in carrying her engine and fuel.

It is next necessary to ascertain what would be the comparative speed on the two systems ; it has been before shown that the speed of the sailing vessel averaged 3¾ miles per hour, and it must be remembered that this vessel averaged considerably above merchant vessels in general. The power of steam allowed is 30 horse for a vessel of 380 tons new measurement, which would be sufficient to propel her at 5 knots per hour, in smooth water and calm weather ; she would then go

6 with a strong leading wind and following sea (without sails), and 3 against a strong head wind ; and in case of a gale of wind she would easily go a head 2 knots keeping the sea on her bow. Her average then in the Indian seas could not be reckoned at less than 4½ knots or 108 miles per day, while a fast sailing vessel only averaged 3¾ knots, the speed of the steamer would therefore be greater by $\frac{1}{5}$, or she would perform a voyage in 48 days, which the sailing vessel would not perform in less than 60 days. The steamer, it is to be observed, carries no standing masts or rigging whatever, but merely 3 light masts with lug sails which she can set up in case of accidents. Whether it might be worth while to use those sails regularly in the trades or in any leading winds, is a subject for further calculation.

For the safety of the two modes, there can be no room for doubt that the steamer having no masts and sails, would be free from most of the dangers to which sailing vessels are exposed ; she would in fact be always in that state to which sailing vessels are obliged to reduce themselves when they have no alternative, in order to avoid destruction, viz. by cutting away their masts.

The conclusion therefore is, that it would be quite as cheap to work a merchantman by steam at 4½ knots per hour, as by sails at 3¾ knots in voyages of moderate length, that is not exceeding on the average 2,400 miles, or varying from 1,000 to 4,000 miles without taking in coal, and that it would be far safer.

But in the above comparison, ordinary voyages only are supposed.

To show more strongly the effect of steam power, we may take the case of a voyage in which the vessel was delayed by accidents, such as frequently occur to sailing vessels ; this vessel lately sailed from Singapoor to Madras ; on her passage she lost one or two of her masts in a white squall, and was obliged to put back into Penang ; and on her making Madras, she encountered so strong a current that she was carried to lee-ward of her port ; and in consequence she was 80 days in completing her voyage.

Comparison of profits of a steamer with the Ship ——— from Singapoor to Madras.

Time occupied in voyage	80 days
Add for loading and discharging	10
Total time of voyage	90 days

Total expence of such a vessel per annum	2151£
Do. for 3 months	£538
Actual receipts of the same vessel	700
Net profits	162£
Do. per annum	650£
which upon 6,000£ is	11 per cent.

Calculation for steamer.

Expences (inclusive of coal)—per annum	2,100£
Do. for 3 months	525 £

FUEL.

	Miles.	
Madras to Penang	1,300	
Penang to Madras (in part)	1,000	
Madras to Penang	1,300	
Coal for miles	3,600 at 2¼ tons for 100 miles, 82 tons at 17 Rupees	140
Penang to Singapoor (4 times)	1,500 miles	
Penang towards Madras	300	
Wood for	1,800 miles at 5 tons, per 110 miles, 80 tons at 2 Rs.	16
Total expences for 3 months		681 £

The steamer has a 30 horse engine with which she averages 4½ knots, which she would do with ease, as she will encounter no head sea, a great part of the voyage will be in perfectly smooth water, and there will be very little head wind. She takes in at Madras coal to work her to Penang, 1,300 miles, and also to work her part of the way back, viz. 1,000 miles, in all 2,300 miles at 100 miles for 2¼ tons, making 53 tons. At Penang she deposits coal for 1,000 miles, taking in wood both there and at Singapoor and Malacca if necessary, for the Straits and also for the first 300 miles out of Penang towards Madras. The wood is taken on deck, and does not interfere with the tonnage.

Tonnage taken up by fuel and engine.

	Tons
From Madras; coal	53
Engine	20
	73
Towards Madras; coal	23
Engine	20
	43
Average ... tons	58
Deduct on account of tonnage saved in stowage of sails and stores	40
Net loss	18 tons
Tonnage of vessel	400
Available for freight	382 tons

As she would perform the voyage of 1,660 miles in 15 days, and allowing 10 for loading and discharging, she would in 90 days perform 3½ voyages, and allowing her to carry 360 tons each time.

Receipts.	£
360 tons of freight at 20 Rupees	720
Add profit on 2 passengers each trip	40
Receipts	760
Or for 3½ voyages	2660
Total receipts in 3 months	2660
Deduct expences	680
Net profits	1980
Or per annum	7920

Which upon an outlay of 5200 £ is 130 per cent per annum.

The above remarks and calculations refer chiefly to a vessel worked with a very small power of engine, viz. 1 horse to 13 tons, in a vessel of 380 tons; it should now be considered what would be the effect of working with rather a higher power, though still one far short of that of the present passenger steamers.

STEAMER OF 380 TONS, WITH A 50 HORSE ENGINE.

COST.

	£
Hull	3600
50 horse engine	2000
Anchors and cables	200
Masts and sails (3 lugs)	200
Total costs	£6000

EXPENCES.

Insurance at 4½ per cent	270
Commander	360
Officer	120
1st Engineer	300
2nd do.	120
Armourer	120
Carpenter	48
4 Sucunnies	120
1 Syrang, 1 tindal, 10 lascars	168
6 Stokers	72
Butler and boy	24
Victualling 19 persons	24
Hired labourer in port	100
Repairing hull 2 per cent	72
Sundries, paint, &c.	50
Replacing hull 3 per cent	108
do. engine 9 per cent	180
Repairs of do. 5 per cent	100
Oil	20
	2376

Coal 26,500 miles at 132 miles per day or 240 days, in 19½

months, 870 tons, or 500 tons per annum at 16 S.	400
Total cost per annum	2776 £

But as the sailing vessel takes 303 days to run that distance, while the steamer would take only 204, there would be 99 days saved out of the 23 months occupied by the former in her voyages; and while the former run 13,800 miles in the year, the latter would run 16,200 in that time; hence

	£
Proportional expence of steaming 13,800 miles	2360
Expence of sailing do. as before	2151
Do. of steaming above sailing	210

That is; the expence of working a vessel of 380 tons, with a steam power of one horse to 7½ tons, would exceed that of sailing the same distance, or of steaming with a power of 1 horse to 13 tons, by £210 in 13,800 miles or by about $\frac{1}{11}$th.

Thus it appears that there is a certain speed at which steam vessels can be worked as cheaply as sailing vessels, but at a little higher speed, the steam power is more expensive.

The loss of freight in consequence of the space occupied by the coals and engine, must next be calculated.

	Tons
Coal for 2,400 miles as before, being 18 days at 4¼ tons per day.	76
Engine	30
Total tons	106
Deduct as before on account of saving in ship's stores	40
Loss of tonnage	66
But as the sailing vessel would be deficient of freight on an average at least 30 tons, the actual loss of freight would be	36
	or $\frac{1}{11}$

	£
Allowing for this, the cost of conveying 350 tons of freight in the steamer would be	2600
And in the sailing vessel	2150

Expence of steaming at this speed above that of sailing...... £450

or ⅕

In the above calculation, the steamer is supposed to average 132 miles per day, or 5½ knots per hour. The speed of a vessel of 380 tons, with a 50 horse engine in smooth water, would be about 6 knots, 4 against a strong head wind and sea, and 7 with a fair wind and following sea (without masts and sails) her average would be at least 5½ knots. This is exactly half as much again as the average of the above fast sailing vessel. According to this the voyages of the steamer, would be performed in two-thirds of the time required by the sailing vessel, but in reality they would probably take considerably less than that.

Thus it appears, that to work a vessel with such a power of steam as would ensure the voyages being performed in two-thirds of the time of a sailing vessel, it would cost one-fifth more; and there can scarcely be a doubt that the other advantages of steam, would far more than compensate for this increase of expence; or we come to the conclusion;

That it would answer as well to work a vessel by steam at an average rate of 5½ knots, as by sails at 3¾ knots, measuring the distances on the nearest line from port to port, supposing that the average length of her voyages without taking in coal, did not exceed 2,400 miles, or that they varied from 1,000 to 4,000 miles, and hence that by the use of steam without any masts or sails, commerce might be carried on in most parts of the world at a speed exceeding by one-half that ordinarily attained at present by sailing vessels, without any increase of expence, and with much greater safety.

If a higher speed than this is required, it must evidently be purchased at a rapidly increasing cost, though this might answer in particular lines of trade, and especially where there was a considerable portion of passengers. And it is evident, that were this system extensively introduced, the carriage of passengers would form a much more considerable item of traffic; for the safety, certainty, comfort and speed of this mode, would increase the number of travellers by sea probably four-fold. The loss of time and uncertainty of passages in sailing vessels, besides their discomforts, make it almost impracticable for men much occupied, to move from one port to another, and they can only do it in very urgent cases. Powerful steamers working at ten knots, would of course be still more effectual, but first, they could not afford to carry passengers, but at a high rate of payment, and secondly, they are not likely at present to be established except on some main lines of intercourse. At the same time, such a means of proceeding at a high speed along a few main lines, would greatly increase the number of passengers on the subordinate ones.

In all that has been said hitherto, it is supposed that the vessel has no standing masts or rigging and never uses sails. She has three small masts on board to be set up on the deck, with temporary rigging on which can be set three lug sails containing in all about ⅓ of the full spread of canvass for a ship of her tonnage; these are merely kept in case of an accident which deprives the vessel of the use of her steam power.

Whether it would be advisable to use these sails occasionally when there was a steady leading wind is a separate question, which may now be considered.

The effect of a spread of canvass equal to ⅓ of that of a ship under full sails, would be ⅝ of her full speed, that is if under full sail she went 8 knots, with a leading wind, she would run 5 knots with ⅓ of that quantity of canvass when the wind is on the beam, or quarter, but with the wind nearly aft, it would make a less difference than that. Further as she would be able to carry such low and small sails, without any weight of masts and yards above them, in a much heavier breeze than a sailing ship could carry full sail, the average difference of rate in the two cases would be much less than 5 to 8. There is a third point which would still further reduce this difference, viz. that as such a vessel would never have to beat or carry a heavy press of sail, she would of course be built on the model of a steamer, that is with a light draft of water, and great length, and consequently would with a leading wind require less sail than such as are built on the model of a sailing vessel, to give her the same speed. Allowing for these three considerations, the average speed of such a vessel with a leading wind could not be taken at less than ¾ of that of a full rigged ship. Hence if a sailing vessel averaged 7 knots while running down a trade, the speed of the steamer from her sails, and without using her engine, would be 5¼ knots and she might therefore put out her fires in such circumstances, without going below her average speed more than ¼ knot, if the vessel of 380 tons has a 50 horse engine; and with a gain of ¾ knot if she has only a 30 horse engine. Or she might use both steam and sails. In such cases, if she could run 5¼ knots by wind only, and 5½ knots by her engine alone, she would have a speed of at least 7½ knots, if she used both together. That is, such a vessel with a 50 horse engine would by the additional use of her sails run at least two knots above her average, and at least one knot more than she would go with her engine and a strong wind nearly aft and a following sea, but without sails. And such a vessel with a 30 horse engine would run at least 7 knots an hour, or 2¼ above her average, and one knot more than she would go under the most favourable circumstances without sails. Supposing then that such vessels used light sails occasionally, such as when running with a trade or monsoon on or abaft her beam, the calculation for her would be as follows;

STEAMER OF 380 TONS WITH 30 HORSE ENGINE.

	£
Expences as before	2050
Renewing and repairing sails per annum	60
	2110
Coal for steaming 15,800 miles at 120 miles per day, 132 days at 8 lbs. per horse power per hour, 310 tons at 16 S..	270
Total expence of steaming 15,800 miles	2380
Do. do. 13,800 miles	2080
Do. do. of sailing do.	2150
Difference in favour of steaming	70 £

The speed of such a vessel would be 3 knots against a head sea and wind, 5 knots in smooth water and calm weather, and 7 using her sails with a trade of average strength; her average could not be less than 5 knots, while the sailing vessel averages only 3¾ knots; or the steamer would perform her voyages in three-fourths of the time of the sailing vessel. The sailing vessel was 303 days at sea out of 23 months, running a distance of 26,500 miles; the steamer would in this case accomplish that distance in 220 days, and consequently allowing the same time in port for both vessels, she would perform the same work in a little more than 20 months, or at the rate of 15,800 miles per annum; for this, allowance has been made in the above calculation.

Hence it appears that a vessel of 380 tons, worked by an engine of 30 horse power, fitted with movable masts and 3 lug sails to be used when there is a steady leading wind, would be worked cheaper at an average speed of 5 knots than a sailing vessel at 3¾ knots; that is, she would at less expence perform her voyages in ¾ of the time of a sailing vessel.

Or if such a vessel with a leading wind, made use of wind only, she would on an average of voyages save about ⅓ of her fuel, and hence she could run 6,000 miles with the same fuel, as she would require for 4,000 miles if she made no use of her sails, and as her speed in that case would be 3 against wind and sea, 5 in calms, and 5¼ on an average, using her sails only ; her total average would be about 4¾ miles or one-fourth more than that of a sailing vessel. That is

A vessel of 380 tons, with a 30 horse engine and fitted with moveable masts and light sails to be used in leading winds, without steaming at such times, could be worked as cheaply as a sailing vessel, in voyages of from 1,000 to 7,000 miles without taking in coals, at a speed ¼ greater, or she would in her voyages save one day in 4.

The effect of occasional use of sails in such a vessel, with a 50 horse engine, may next be examined.

STEAMER OF 380 TONS WITH ENGINE OF 50 HORSE POWER, using light sails occasionally.

	£
Expences as before, omitting coals	2376
Renewing sails, per annum	60
	£ 2436
Coal for 16,800 miles at 150 miles per day at 8 lbs. per horse power per hour, 480 tons at 16s	384
Total expense of steaming 16,800 miles	2820
Do. of do. 13,800	2320
Do. of sailing do.	2150
Excess of expense of steaming	170
	or $\frac{1}{12}$

The speed of this vessel would be 4 knots against a head wind and sea, 6 knots in smooth water and 7½ using her sails also ; taking her average at 6¼ knots, she would perform her voyages in ⅔ of the time of the sailing vessel. She would have performed the distance run by the latter, viz. 26,500 miles in 177 days, instead of 303, saving 4 months out of 23, the whole time occupied by the sailing vessel, and running in the year 16,800 miles. Allowing the steamer to lose as before calculated $\frac{1}{11}$ of her freight, the proportional expence for the same amount of tonnage would be

	£
Expence of working steamer as above	2320
Add for loss of tonnage $\frac{1}{11}$	220
	2540
Expence of sailing vessel	2150
Net increase of expence in steaming	£390
	or not ⅕

Hence it appears that at an increased expence of less than ⅕, a loss which there can be little doubt would be far more than compensated by the additional passengers, and other advantages hereafter enumerated, vessels could by this means be worked at a speed increased from 3¾ knots to 6¼ or in the proportion of 3 to 5, or a voyage which now takes 60 days would be performed in 36. That is

That a vessel of 380 tons, with a 50 horse engine, and using light sails in strong leading winds, would be worked as profitably at 150 miles a day, as a sailing vessel at 88 miles per day, or she would perform her voyages in ⅗ of the time of a sailing vessel with far greater safety, certainty and comfort to all on board; voyages ranging from 1000 to 4000 miles without taking in coal.

The above calculations are made from the actual expences and voyages of a fast sailing vessel, very profitably employed in the Indian seas. She can take in coal at Calcutta, Madras, Bombay, Singapoor and Sydney, and as she can obtain no freight on the return voyage from Sydney, she could bring back a full cargo of coal, and deposit part of what she does not use at P. Essington or King George's Sound, according as she returns by Torres Straits or C. Lewin, and part at Anjer, Singapoor or any convenient port, as may best suit her. Or she could have coal brought up by the numerous vessels sailing in ballast from Sydney for India, at a moderate cost. With a depôt of coal at P. Essington, King George's Sound and Anjer, she would never have to steam more than about 2000 miles without taking in coal, and the average distance without a fresh supply would not exceed 1800, while the calculations allow an average of 2400 miles.

It must also be remembered that the vessel used for comparison was undoubtedly much above an average sailer, so that the gain of speed and time by the use of steam would be certainly on an average greater than the calculation given.

We may now take a new case for examination, and that the comparison may be as complete as possible, the case of a vessel employed to carry coal, and without passengers, on as long a voyage as it can be necessary to carry coal, may be investigated. This must be considered an extreme case, for if it will answer to carry coal on a long voyage by a steamer, there can be no doubt that it will answer for any thing else.

Vessels are sent from Llanelly in Wales, to Bombay with coal for the steamers there. They are quickly loaded, and get the coal at about 7s. a ton, and receive from 35 to 40s. freight for it. A vessel making an average voyage fully loaded with coal, will perform the passage in 120 days, and complete her trip, so as to be ready to receive another cargo in about 5 months.

EXPENCE OF A SAILING VESSEL OF 600 TONS, taking out 900 tons of coal.

	£
Cost of hull	6000
Fitting for sea	3800
Total cost	£9800

EXPENCES.

	£
Insurance at 4½ per cent	450
Commander	120
2 Officers	102
Carpenter 60£, boatswain 36£	96
	768
Steward 36, cook 36	72
30 men at 30£	900
Victualling 3 officers	135
Do. 34 hands at 1s. per day	612
Renewing sails	50
Rope	40
Spars, &c	30
Pitch, &c	25
Repairing hull 5 per cent	300
Replacing hull 3½ per cent	210
Port charges	60
	3202

Sundries	40
Total per annum	3242
Do. for 5 months	1350 £

Steamer of 600 tons.

	£
Hull	6000
Engine 30 H. P.	1200
Masts and sails	280
Anchors and cables	300
Total cost	£7780

EXPENCES.

	£
Commander and officers	222
Engineer	144
Armourer (capable of taking charge of engine)	84
4 Stokers	240
Carpenter	60
Steward and cook	72
10 men	300
Victualling 5 as officers	225
Do. 17 at 1s.	300
Renewing sails and ropes	30
Oil and pitch	20
Repairing hull 2½ per cent	150
Replacing hull 3½ per cent	210
	2057

	£
Repairing engine 5 per cent	60
Replacing do. 10 per cent	120
Insurance 3½ per cent	273
Port charges	60

Sundries	40
Expences per annum	£2610
Do. for 4 months and 5 days	905 £
Coal for 95 days, at 8-lbs. per horse power per hour, 2½ tons per day at 7s.	83
Total expence for 640 tons 11,000 miles	988 £

		s.	d.
Do. do. per ton	£1	11	6
Expence by sailing vessel 900 tons	1350		
Do. per ton	£1	10	0

That is the expence of steaming would exceed that of sailing by 1s. 6d. per ton carried, but 25 days would be saved in the voyages.

PROFITS ON SAILING.

Supposing the freight to be 2£ per ton.	£
Profit on 900 tons at 10s. (in 5 months)	450
Proportional profit in a year	1080
Which upon a capital of 9800£ is	11 per cent.

PROFITS ON STEAMING.

	£
640 tons at 8s. 6d. (in 4 months 5 days)	272
Proportional profit per annum	782
Which upon 7780£ is	10 per cent.

That is the profits upon the voyage by the sailing vessel would be 11 per cent. and in the steamer only 10 per cent.

In the above estimate, the coal carried by the steamer is thus reckoned

	Tons
Total coals conveyed in sailing vessel	900
Deduct coals consumed 240 tons, engine 20 tons.	260
Coal conveyed by steamer	640 tons

The sailing vessel in this case, with a full cargo of coal, is supposed to make her voyage in 120 days, and as the distance measured on the nearest line is 11,000 miles, this is, at the rate of 92 miles a day, or 3¾ knots per hour. The steamer is supposed to go 4½ knots in smooth water, on an average against the wind 3, and 7 with a good breeze and steam together, averaging on the whole 4¾ knots, which would make her voyage 95 days. It is to be observed that the steamer is built with a light draft of water, and of great length like other steamers, and not like a sailing vessel, so that light sails would give her much greater speed than the same quantity set on an ordinary sailing vessel. Also that she consumes 240 tons in the course of her voyage, so that her cargo taking the average of the voyage is 120 tons less than that of the sailing vessel. In the course of her passage, she would not encounter a head wind on many days as she would of course choose her route, so as to avoid them as much as possible; for instance after crossing the line she would keep so near the West Coast of Africa as to avoid the steady S. E. trade.

But if upon estimating such a case as the above, there should be any thing like reason to believe that it might answer, how evident it must be, that for the first class of passenger ships to India it would certainly be in every respect the most eligible plan. Some trials are already making on the use of steam of small power in such vessels, and there cannot be a doubt that it will be a great advantage, but in applying it as at present to assist a full rigged vessel, the main advantages are lost, viz. safety, convenience and comfort. As long as ships carry masts, they must be exposed to many dangers which they would not otherwise encounter. By getting rid of the standing masts and rigging altogether, the vessel is made almost independent of the weather, she can scarcely ever receive any damage in the open sea, and even on a lee shore, a very moderate power of engine would enable her to keep an offing. She would be built on a steamer model with which she would require a much more moderate power of engine than the present vessels to give her the same speed; besides which, both from her greater length, and from her upper deck being unencumbered, she would have about twice as much accommodation for passengers as a sailing vessel of the same tonnage. Further, she would be always nearly upright, and as she would be mostly in those parts of the ocean, where she would find the lightest winds and smoothest water, she would seldom have much motion. When it is thus considered that such a vessel would have such decided advantages over any vessel with standing masts, in safety, comfort, convenience, speed and extent of accommodation, and it has been already shown how near she would come to the latter in point of expence, there seems no room for doubt that there could be no comparison between the two, as passenger ships. In such a vessel the passengers would scarcely be disturbed one night in a whole voyage.

But perhaps the most important application of this system at present would be to the emigration to New Holland. Those noble colonies afford an unlimited field for the employment of all classes of people, and the grand desideratum above all others for them, is the means of a safe, convenient, rapid and cheap transport of emigrants. At present the governments of the different colonies allow 20£ for every adult male, and a proportional sum for women and children. A vessel of 600 tons, new measurement is allowed to carry about 240 persons. Such a vessel will ordinarily draw about 17½ feet of water, with a length of 125 feet. A vessel of the same tonnage, built as a steamer, need not draw more than 11½ feet, perhaps less; and with the same beam as a sailing vessel of the same measurement, she would have a length of 180 feet, which would give her full half as much room again for passengers' accommodation, and as her upper deck would be unencumbered, and might therefore be occupied for ¾ of her length by passengers, her accommodations altogether would be fully double those of a sailing vessel of the same tonnage, or she could carry 480 persons of all ages. A vessel of that class is at present chartered for about 2500£, which gives about 10£ a head for each individual emigrant exclusive of their food; this costs, it is said about 3£ 10s. making the total actual expense of transport probably about 15£ a head, including sundry expences; the government allows at present 20£ for men, and the profit may be on an average 2£ a head upon all ages. The question is at what cost a vessel of this tonnage worked by steam could be taken out to New Holland, in comparison of that of a sailing vessel. An average passage at present is about 110 days, and the distance measured on the nearest line is 12,800 miles from Plymouth to Sydney, giving an average of 107 miles per day or 4½ knots per hour. A 600 ton steamer with an engine of 40 horse power would run 5½ knots in smooth water, 3½ on an average head to wind, and 8 on an average with steam and light sails while in the strong westerly winds between the Cape and Bass' Straits (about half of the voyage); giving a total average of about 5½ knots an hour, and a length of 90 days for the passage, of which the fires may be out for at least 20 days, when the westerly winds are very strong, leaving 70 days of steaming to be provided for. Her cargo at starting would then be;

	Tons
75 days coal at 3½ tons per day	260
Water and provisions for 360 persons	180
Engine and sundries	50
Baggage, &c	90
Total weight on board	tons 580

She would of course become lighter every day, and towards the end of the voyage would have a considerably increased speed on that account, while it would not be at all necessary to have any great weight in a vessel not carrying any sails on a wind, and only very light ones when the wind was fair. Her expences would be ;

	£
Annual expences as before given, excepting coal	2610
Do. for 110 days	803 £
260 tons of coal taken in, in London at 18	231
Total expences of voyage	1040
Which for 360 persons would be per head	3 £

A sailing vessel of that tonnage would carry 240 persons, and occupy 4½ months in all on the voyage.

	£
Annual expences of a 600 ton ship as before	3240
Do. for 4½ months	1215
or per head	5 £

Hence it appears that the cost would be 5£ a head in a sailing vessel and only 3£ a head in the steamer, while the voyage would be shortened 20 days, besides all the advantages of safety, comfort and certainty already enumerated, thus giving the advantage to the steamer in a great degree, and in every respect.

The cost of provisions would also thus be reduced nearly one-fifth, causing a further saving per head of 12s. The expence of ship and feeding, would then be 6£ a head, or including sundries probably not more than 8£ a head on an average. The expence in larger vessels would, probably be still less, and there is therefore a fair prospect that the colonies might get emigrants brought out at ⅔ of what they at present pay for them ; which is further shown thus ;

	£	
Actual expences of sailing vessel	1215	
Rate at which it can be chartered	2500	
Actual expences of steamer	1040	
Proportional rate of charter	2100	
240 persons in former gives per head	10 £	
340 do. in latter do. do.	6 £	
Saving	4 £	
Add do. food..	0	12
Total saving	4	12

which, taking men and women and children together, is about ⅓ of what the colonies now pay for them. This too allows a profit of 1060£ upon the voyage which is probably too much, as such vessels would certainly have the choice of freight and passengers for the home voyage. They would generally go home by the Cape of Good Hope, instead of Cape Horn, which would be a much preferable passage. For half the year, they might go by C. Lewin, and the other half through Torres Straits. A vessel went home by the latter route this year, and there seems little room for doubt, that shortly it will be preferred by all vessels, as being shorter, and a fair weather-voyage almost throughout. The dread of Torres Straits for sailing vessels has now nearly passed away, and there is still less objection to a steamer making that passage than a sailing vessel. Such vessels might also be used to meet the Indian steamers at Batavia or Trincomalee. The former would take them but little out of their way, on their passage home from Sydney by Torres Straits. There is a difficulty to be got over in respect of carrying the number of emigrants proposed, as being greater than that at present allowed by law that is, if the vessel is measured for emigrants by the same rule as for tonnage, viz. taking the depth into the calculation, but if they are measured as transports are measured for troops, viz. by the breadth and length only, there would be no difficulty in the matter. If, however, the number at present allowed is in proportion to the tonnage, it would be necessary to get an act passed for this new class of vessels, and as they would be in every respect so far preferable for conveying emigrants, there is little doubt that the act required could be obtained.

It may yet be worth while considering how far this principle might be applicable to men-of-war. The steam frigates already built, have as usual in commercial vessels, engines of great power, but they consequently are subject to the serious drawback of carrying fuel for 20 or 30 days only, and must consequently be fully rigged, which both obstructs them when steaming to windward, and encumbers their decks. Steamers of moderate power on the contrary, would have the disadvantage of being less fast, but they would carry coal for several months, and would have the whole battery on the upper deck, free from all encumbrance. It seems probable that vessels of the three classes acting together, would form the most effective squadron, that is, if it consisted of a small number of steamers of full power; three or four times that number of steamers of moderate power, and a few sailing vessels. As men-of-war probably do not make their voyages on an average at a greater speed than 5 knots, measured on the nearest line from port to port, the proposed vessels need not have engines of greater power than would be sufficient to give them that average rate with the help of movable masts and light sails—to be used in running in a trade or monsoon, and consequently they might be perhaps one-fourth of the power of those in the present steam frigates.

A 52 gun ship, supposing her tonnage to be 2,200 tons, would require an engine of about 100 horse power to propel her at 5½ knots in smooth water, which would consume 9 tons of fuel per day, and consequently with 900 tons, she could steam at her full speed on an average, 13,000 miles, and supposing that in the course of her voyages she sailed without using her engines 4,000 miles, she would then be provided for a distance of 17,000 miles, with that quantity of fuel, which is perhaps as much as men-of-war on an average sail in 12 months, measuring the distances on the nearest line from port to port. But it would be seldom if ever necessary for such a ship to be provided with fuel for 17000 miles, as coal is now to be obtained in Calcutta and Sydney, as well as in England and North America. These vessels in action would possess almost all the advantages of steamers of full power, as they could choose their position independent of the wind, and all hands would be at liberty for the guns, while from their carrying lighter engines, they could bear heavier batteries.

Upon this review of this very important subject, there appears, to say the least, abundant reason to believe that the use of steam of moderate power in vessels of all classes is well worthy of the attention of the merchant, the naval officer, the statesman, and the philanthropist, as well as of the iron master, the engine-maker and the coal proprietor.

Some of its advantages may be thus generally stated;

1st.—Such a vessel would be far preferable for passengers; the time of her voyages would be only $\frac{4}{5}$ of that of sailing vessels, and it would be almost certain to a day; her upper deck would be quite clear, leaving much more room for accommodations; she would be much cooler, for there would always be a current of air through her; instead of seeking those parts of the ocean where there is most wind and consequently most sea, she would always rather choose those where there were calms and smooth water; she would be so little affected by the weather that it would very rarely happen that there would be any cause of alarm from it. She would be liable to accidents from steam, but many years of experience have now proved beyond a doubt that the danger in steamers is extremely small, the number of accidents compared with the number of voyages made, being much fewer than in similar voyages in sailing vessels. On these accounts she would be sure of a much larger proportion of passengers, and at the same time be capable of carrying a greater number than a sailing vessel, so that while she would carry as much freight, she would carry more passengers and consequently be more profitable.

2d.—On account of the greater speed and certainty she would also be preferable for freight and would be sure of the most valuable freight in the market, and also she would be more generally filled than a sailing vessel.

3d.—When leaving one port for another so situated that owing to the monsoon or trade, a sailing vessel would have to make a vast circuit, she would run direct or nearly so, excepting in one or two peculiar cases, such as leaving Bombay for the westward in the strength of the south-west monsoon, but as sailing vessels could not then attempt such a voyage, she would still be on a par with them even in such a case.

4th.—There would not be half the objection to her touching at intermediate ports as to sailing vessels which are always liable to be delayed by calms and variable winds when they are going in or out of port, whereas a steamer would lose no more time by it, than was necessary to steam such a distance out of her course.

5th.—The charge of such a vessel to both her commander and her officers would be incomparably easier and more pleasant than that of a sailing vessel; nothing less than a gale of wind would make it necessary for them to undergo exposure or fatigue; the commander especially would scarcely have a cause of a moment's anxiety in a whole voyage, and even in approaching land they would be almost as much at ease as in the open sea.

6th.—From the absence of all strain from the masts and sails, the vessel would scarcely ever require repair, or be in danger of leaking, and it must consequently be very seldom that she would require to be docked; for she would never be exposed to the trial which the passenger steamers worked at high speeds undergo, in being forced with great power of steam directly through the heaviest seas at 5 or 6 knots an hour.

7th.—Such a vessel would often obtain a freight of unusual value, on account of her speed and certainty, which might make it worth a merchant's while in many cases to charter her above the ordinary rate of freight. And, indeed, it is not improbable that such a vessel would regularly command a higher freight than sailing vessels.

8th.—She would frequently obtain employment as a tug or to assist a vessel in distress, which she could do where sailing vessels would be of no use, and so become entitled to salvage.

9th.—As the time she would require for any voyage would be almost certain to a day, she would often obtain freight or charter for a short trip, while waiting for cargo for a longer one; which a sailing vessel could not venture to do, from the uncertainty of the time of her absence from port. The steamer would in this way be incomparably more handy than a sailing vessel, and would in fact probably do half as much again in the same time. For in a great proportion of mercantile transactions certainty as to time must cause a preference.

10th.—In the case of emigrant ships, which generally have more spare room in their hold than would carry the engine and fuel; the speed, the unencumbered state of the upper deck, the certainty as to time, the small number of the crew, the vessel being almost always upright, these things must give her a prodigious advantage over sailing vessels.

11th.—The same reasons as mentioned in the last paragraph, would always secure the preference of such vessels for the conveyance of troops, and indeed those advantages would be so considerable as probably to secure a higher rate of charter as transports.

12th—Is it too much to suppose that if commerce were generally carried on in these vessels, the loss of life and property would be reduced to one-fourth of what it is at present. Of vessels lost at present perhaps nine-tenths are lost upon rocks or on the coast, but of all such how very few there are that would not have been able to keep clear of the land, if they had had a moderate power of steam on board, instead of being dependent upon sails ; and of those that are lost in the open sea, almost the whole are lost through their masts, from which cause of danger, the steamers would be freed.

13th.—All possible improvements in chronometers, and the means of finding the latitude and longitude, would have an effect upon navigation not worth mentioning in comparison of what would be effected by the general use of steam, for there would then be no necessity whatever for ascertaining a vessel's position to a nicety ; in approaching the land it would be a matter of little consequence to her whether the weather was thick or clear, or whether she made the land to windward, or to leeward of her port ; and when she did run into any danger she could just as easily run out of it again ; not that it is impossible for a steamer to be lost, but in nine cases out of ten, a position which renders the loss of a sailing vessel inevitable, would not in the least endanger a vessel without masts but with a moderate steam power.

14th.—In the case of war steamers, a small squadron could carry a large body of troops, as the length of the voyage would be almost certain, and they could not only appear at any moment upon any point of an enemy's coast, but they might proceed direct up any navigable river, and land the whole force, complete and fresh, in the heart of the country, and also proceed up the rivers in support of them after they were landed.

15th.—It is by no means the least important feature in this plan, that those vessels would draw little more than two-thirds of the water, that vessels intended to carry heavy masts and to work to windward must draw, so that they would enter ports, rivers and channels, where at present vessels of two-thirds of their burthen could scarcely enter. Thus many harbours and rivers at present almost useless as ports, would become equal in value to those now containing half as much water again.

It may here be remarked, that in all the above calculations of expence the commander and officers are supposed to be unacquainted with the steam engine, but it is evident that if the system was introduced, they would soon be men as well acquainted with the management of an engine as they are at present with that of the sails, for the former would be as much their business in steamers without sails, as the latter is at present. This would of course reduce the expence materially.

In conclusion it must be remembered that all the calculations in this paper are made upon the present state of the marine steam engine. Taking into consideration that every year adds some improvements, is it too much to expect that by the further reduction in the quantity of fuel required, the advantages may be so decidedly in favour of steam, that sailing vessels will in time, be as few in proportion as steamers are now.

For instance it is well known that the mine engines in Cornwall, are some of them worked with less than 2-lbs. of coal per horse power per hour, which is one-third of the quantity consumed in the best engines at present afloat, and a quarter of what is allowed in the above calculations; and again with respect to the weight of boilers, those used on railroads and making steam sufficient for a 50 horse low pressure engine, weigh only about 6 tons. From what has been thus already accomplished in other branches of steam power, we may fairly conclude that much will yet be done in engines used for marine purposes.

The principal difficulty to be overcome in the introduction of such a new system as this in navigation would be the persuading men to trust themselves at sea without standing masts; it is well known how difficult it is to lay aside any thing in which men have been accustomed to trust for ages; the use of masts in the powerful coasting steamers, after so many years have shown that they are of little or no use, is a case in point. A remarkable instance was also seen in the case of the introduction of chain cables; ships were not trusted at sea without a hempen cable, till very long after they had ceased to be used. But the removal of standing masts is an *essential feature* in the proposed plan for neither can very low steam power be used, if vessels are to encounter the resistance of the wind to masts and rigging, nor can a masted vessel be worked with the small crew proposed.

If a sufficient crew is to be carried to work sails, it alters the whole case, and such an arrangement is not the one proposed. The question is, whether it will not answer to work a vessel by low steam power *instead* of by the winds.

October 1840.

III.—*On the Separation of the Pomegranate as a distinct Natural Order from Myrtaceæ.—By* Robert Wight, m. d., &c.

The most eminent botanists of the present day being divided in opinion as to the propriety or otherwise of separating the Pomegranate as a distinct natural order from Myrtaceæ, I have recently been induced to examine this question, bringing to my aid the lights thrown on carpellary arrangement by my recent investigations of Cucurbitaceæ.

The result of this examination has led me to the conviction, not only that Granateæ is a distinct order, but that the pomegranate, if my views are correct, is, so far as our information yet extends, the most remarkable fruit in the system of plants. But, without further preface, I shall at once proceed with the subject, introducing it by presenting a series of extracts from the leading disputants on either side. The whole controversy turns on a simple question of fact, namely, what is the structure of the ovary and fruit of Punica? To these points therefore I shall, to save room, limit my extracts. The first of these, taking them in chronological order, is from Mr. D. Don's paper, Edin. New Philosop. Journal, for July 1826. The second is from DeCandolle's Prod. 3. p. 3. The third is from Dr. Lindley's Natural System of Botany, ed. 1st, page 64, and repeated in the second edition. The last is from Mr. Arnott's article Botany, Ency l. Brit. ed. 7, page 110, under Myrtaceæ. These extracts, by placing the question before the reader in all its bearings, will enable him at once to judge, how far I have succeeded in setting the question at rest

" *Bucca* pomiformis, limbo tubulosa dentato calycino, nunc contracto, coronata: *cortex* crassissimus, extùs cuticulâ lævi rubicundâ punctatâ lucidâ vestitus, intus spongioso-carnosus, albus, dein, maturâ baccâ, fissurâ irregulariter rumpens. *Placenta* cortici baccæ substantiâ simillima, at magis carnosa et succulenta-baccam omnino replens, in loculis numerosis polyspermis inæqualibus reticulatim atque interrupte excavata. *Dissepimenta vera* nulla: *spuria* tamen adsunt, quæ e substantiâ placentæ orta, valdè sunt fragilia, et crassitie variâ. Don (l c.)

" The real structu e of the fruit of the pomegranate appears to have been overlooked by all authors, I have consulted on the subject, and even the distinguished Gærtner has fallen into error both in his description and figure. It is in reality a fleshy receptacle, formed by the tube of the calyx into a unilocular berry, filled with a spongy placenta, which is hollowed out into a number of irregular cells, in which the seeds are placed ; the dissepiments being nothing more than thin portions of the placenta. If we could conceive the fruit of *Rosa* to be filled up with an interrupted pulpy matter, it would be exactly of the same structure as the pomegranate." Don (l.c.)

" Fructus magnus, sphæricus, calycis limbo subtubulosa coronatus, ejusdem tubo corticatus, indehiscens, diaphragmate horizontali inæqualiter bicameratus ; camerâ superiore 5-9-loculari, camerâ inferiore minore 3-loculari, septis utriusque membranaceis loculos separantibus ; placentæ cameræ superioris carnosæ a parietibus ad centrum tendentes, in inferiore processus irregulares ab ipso fundo" D. C. (l.c.)

" The fruit of the pomegranate is described by Gærtner and DeCandolle, as being divided into two unequal divisions by a horizontal diaphragm, the upper half of which consists of from 5 to 9 cells, and the lower of 3; the cells of both being separated by membranous dissepiments ; the placenta of the upper half proceeding from the back to the centre, and of the lower irregularly from their bottom ; and by Mr. Don as a fleshy receptacle formed by the tube of the calyx into a unilocular berry, filled with a spongy placenta, which is hollowed out into a number of irregular cells. In fact, if a pomegranate is examined, it will be found to agree more or less perfectly with both these descriptions. But it is clear that a fruit as thus described is at variance with all the known laws upon which compound fruits are formed. Nothing, however, is more common than that the primitive construction of fruits is obscured by the additions, or suppressions, or alterations, which its parts undergo during their progress to maturity. Hence it is always desirable to obtain a clear idea of the structure of the ovarium of all fruits which do not obviously agree with the ordinary laws of carpological composition. Now, a section of the ovarium of the pomegranate in various directions, if made about the time of the expansion of the flowers before impregnation takes place, shews that it is in fact composed of two rows of carpella, of which three or four surround the axis, and are placed in the bottom of the tube of the calyx, and a number, varying from five to ten, surround these, and adhere to the upper part of the tube of the calyx. The placentæ of these carpella contract an irregular kind of adhesion with the back and front of their cells, and thus give the position ultimately acquired by the seeds that anomalous appearance which it assumes in the ripe fruit. If this view of the structure of the pomegranate be correct, its peculiarity consists in this, that, in an order the carpella of which occupy but a single row around the axis, it possesses carpella in two rows, the one placed above the other, in consequence of the contraction of the tube of the calyx, from which they arise. Now, there are many instances of a similar anomaly among genera of the same order, and they exist even among species of the same genus. Examples of the latter are, Nicotiana multivalvis and Nolana paradoxa, and of the former Malope among Malvaceæ ; polycarpous Ranunculaceæ as compared with Nigella and polycarpous Rasaceæ as compared with Spiræa. In Prunus I have seen a monstrous flower producing a number of carpella around the central one, and also, in consequence of the situation, upon the calyx above it ; and, finally, in the *Revue Encyclopédi que* (43.762.) a permanent variety of the apple is described, which is exactly to *Pomeæ* what Punica is to *Myrtaceæ.* This plant has regularly 14 styles and 14 cells, arranged in two horizontal parallel planes, namely, 5 in the middle, and 9 on the outside, smaller and nearer the top; a circumstance which is evidently to be explained by the presence of an outer series of carpella, and not upon the extravagant hypothesis of M. Tillette de Clermont, who fancies that it is due to the cohesion of 3 flowers." Lindley (l.c)

" To the Myrteæ we, with Mr. Lindley, unite the Granateæ, because *Punica* or the pomegranate only differs by having its two verticels of carpels developed instead of one, and perhaps in a truly wild state the upper or adventitious one may occasionally disappear. The inner series (or those at the bottom of the fruit) have their placentæ in the axis; but the outer series, forced to the top of the fruit by the contraction of the mouth of the tube of the calyx, having their placentæ in the ovary at the back of the inner carpels, exhibit them in the ripe fruit in a horizontal position on the upper surface of the lower cells." Arnott (l.c.) et Prod. Fl. Peninsulæ, 1, page 327.

Premising that the whole controversy turns on these questions,—1st what is the true structure of a pomegranate? and 2d, whether the difference between it and Myrtus is sufficient to separate these genera as distinct orders?—I shall now proceed to examine these conflicting statements, and endeavour to ascertain on which side the balance preponderates, and whether, indeed, there is not room for an explanation different from any of those yet proposed.

Mr. Don's description of this fruit, on the strength of which he first proposed to remove this genus from Myrtaceæ, the order with which it was previously associated, as a distinct family, appears to me most unphilosophical and altogether untenable. He, as I understand, considers the fruit a one-celled receptacle, the centre of which is filled with a spongy placenta, round the surface of which there are a number of irregular cells occupied by clusters of ovules, but he does not tell us how the central placenta got there, neither does he account for the ovules being attached to the parietes of the cell, and not to the central placenta. His whole description in fact proves that it had been drawn up from inadequate examination, and that he, at the very time he is accusing all authors of overlooking the real structure of the fruit, totally misapprehends it himself, as we shall by and by see.

DeCandolle gives a more correct description of it when he says, that it consists of two chambers, the under 3-celled, the upper from 5 to 9-

celled, with the placentas of the upper cells reaching from the parietes to the centre, while those of the lower division proceed irregularly from the bottom of the fruit He does not, however, assign this peculiar structure as his principal reason for viewing the order as distinct from Myrtaceæ, but has recourse to others, in my estimation, of minor importance.

Lindley conceives that there are two rows of carpels, three or four of which surround the axis at the bottom, while the remainder surround these, and, occupying the upper part of the fruit, adhere to that part of the tube of the calyx. The placentas of these upper carpels, he conceives, contract an irregular kind of adhesion with the back and front of their cells. The meaning of this is far from being clear to me, but if it means that he considers the placentas of the upper as well as the lower row to proceed from the axis towards the circumference, to which last they contract accidental adhesions, then he takes an erroneous view, and if the examples quoted in illustration support this view, they are not in point as regards the structure of Punica.

Mr. Arnott, like Lindley, views the fruit as consisting of two rows of carpels, an outer and inner, the former of which he thinks may be adventitious. To understand his theory, we must first suppose the tube of the calyx spread out as a flat surface and covered with two circles of carpels, the inner next the axis, and the other occupying a larger circle beyond, that the margin of the calyx then contracts so as to turn the outer series over the inner. According to this supposition, the attachment or base of the placentas of the outer series should be in the circumference, and the apex in the centre, while that of the inner should be in the opposite direction, that is, have the base in the centre and the apex towards the circumference; an explanation which is in accordance with what we find, except in so far as it does not account for the horizontal partition between the two series: nor can I exactly understand on what ground we are warranted in assuming that the outer series is adventitious and the result of cultivation, as it has every where been found so constant in all circumstances. But be that as it may, this theory certainly accounts for the crossing of the placentas in the two rows which we so invariably find, whether correctly or not, cannot be determined, until we get fruit with a single row of carpels, which has not yet been found.

These explanations, which I venture to propose, of rather obscure descriptions, did not occur to myself until after I had formed a new theory of my own, the result of a very careful examination of the ovary in all stages from the earliest, up to the period of impregnation. At these early stages, when the whole flower had not yet attained half an inch in length, probably a fortnight or more before expansion, I invariably find two rows of carpels, one inferior, of 4 or 5, and one superior of 5, 6 or more. In the lower series the placentas are ranged round the axis, with their base in the centre, and the apex, which is free, towards the circumference. In the upper, the attachment, or base of the placentas, is in the circumference, and the apex, also at first free, directed towards the centre. Between the two rows a diaphragm is always interposed. The apex of the upper placentas is, occasionally, afterwards prolonged and contracts adhesions to the axis.

In the accompanying figures I have attempted to represent these views. As the fruit advances in size considerable derangement of this structure progressively occurs, which is apt to mask and confuse the appearances now described.

Having previously ascertained the occasional existence of inversion in the position of carpels, my first idea was, that such an inversion took place in the upper row. This view, which, equally with the preceding, accounts for the crossing of the placentas, I feel inclined to adhere to, though I confess not without some hesitation, because it implies a complexity of arrangement rarely met with in the inimitably simple and beautiful operations of nature; but I think it as difficult to imagine the nearly equally complex and inconceivable operation of the folding in of one set of carpels over the other, which Drs. Lindley and Arnott's explanation demands : while my explanation has the advantage of at the same time accounting for the double chamber which the ovary presents from its earliest stages, and renders unnecessary the doctrine of an adventitious verticel of carpels, which for the present is mere assumption.

With these explanations, I leave the question of structure to consider the one pending on its determination, viz. whether or not Granateæ ought to be preserved as a distinct order or be re-united to Myrtaceæ ?

On this point, so far as the unvarying evidence derived from cultivated plants is entitled to carry weight on a disputed point—and which I presume it must do until we find that evidence invalidated by the examination of others growing in a truly wild state—we must unquestionably, I conceive, adopt the views of those who urge the separation, because the complex structure, above described, being constant here and unknown among the true Myrtaceæ, we have no right, in the total absence of direct confirmatory evidence, to assume, that a part is adventitious, merely because it is at variance with our ideas of what should be, especially while we have, in addition, difference of habit in the formation of the seed, and their pulpy envelope, in further confirmation of the correctness of these views.

In coming to this conclusion, I do so, mainly on the evidence I have myself adduced: attaching no value to the opinion of Mr. Don, which, being founded, according to his own showing, on most erroneous view of the structure of the fruit, does not merit much consideration.

To the views of DeCandolle more importance must necessarily be attached, as the reasons he assigns are more satisfactory, though I do not think he has attached sufficient value to the very peculiar "economy of the fruit," while he has given too much to others of much less note, such as the want of pellucid dots, the absence of the marginal nerve of the leaves, and the pulpy covering of the seed; thereby throwing into the shade the true essential character of the order, which unquestionably lies in the double row of carpels, with the upper placentas parietal and crossing the lower axillary ones, which, if I have rightly accounted for, constitute this a truly curious and unique fruit; and which, whether or not my theory of its construction be correct, is yet so very different from that of every true Myrtacea, as to leave no doubt of its forming the type of a distinct order.

EXPLANATION OF PLATE.

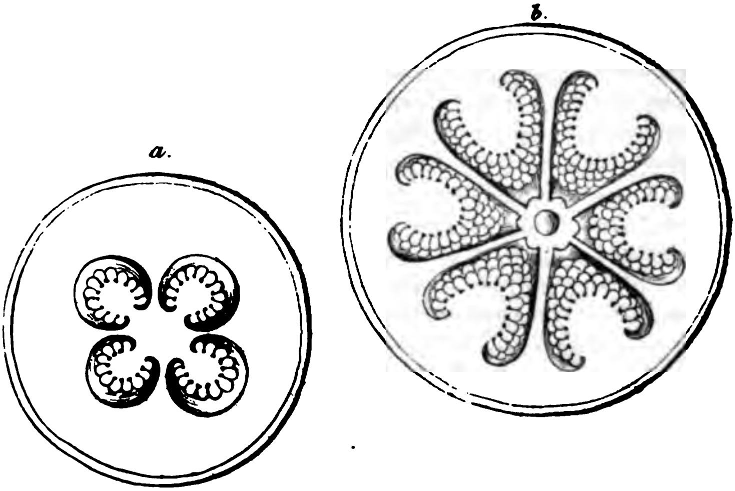
1.—a. Section showing the lower series of carpels in the ovary of the Pomegranate many days before the expansion of the flower.

b. Section showing the upper series of carpels. These two figures are taken from opposite sides of the same slice.

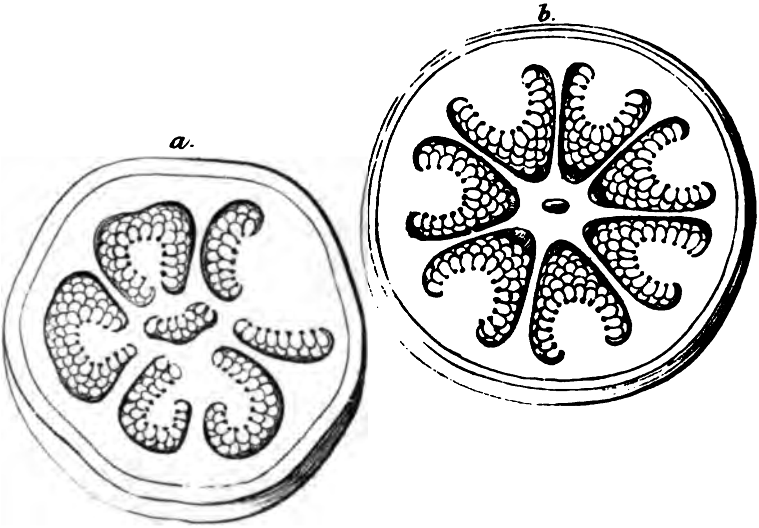
2.—a. Section showing the lower series of carpels in an ovary some days after the expansion of the flower. At this time considerable derangement has taken place apparently caused by the rapid expansion, in a confined space, of the ovules after impregnation.

b. Upper series in the same ovary, and, as in the former instance, taken from the opposite sides of the same slice. Here the derangement so obvious in the lower section has not taken place.

1.



2.



IV.—*On the Construction and use of Portable Barometers.—By Captain* J. Campbell, *Assistant Surveyor General.*

1.—From some cause, not yet properly investigated, barometers, as hitherto constructed for portability, generally become damaged on the voyage to this country, and even are liable to injury during transport on land in this climate. I consider it likely that the plan on which these instruments are constructed is faulty, and that the expansion of the mercury in those, the tubes of which are closed by a screw, is sufficient to cause the fracture of the tube. It is even probable, when carried in an inverted position, that the expansion of the mercury in the tube and the air in the cistern, which in this position will be of course in the bottom part of it, is sufficient to force out the mercury through the pores of the cover, and that the alternate expansion and contraction of this portion of air, according to the changes of temperature, may be sufficient to force out all the mercury in the cistern, or to leave so little in it, that, on setting up the instrument, there is not sufficient left to cover the aperture of the tube.

2. On examining a damaged mountain barometer, on "Newman's improved portable iron cistern" plan, I consider I have found some reason to suppose that the above remarks may be correct, and as the construction of the instrument is not generally known, I append the following description.

3. The cistern of this instrument is formed of a cylinder of iron 2½ inches long and 1 inch and three-tenths in diameter. The cover of it is a close grained piece of box wood, cemented on to the tube and screwed tightly into the cistern. Through the pores of this piece of wood the air finds a passage to exert its pressure on the surface of the mercury; and, under considerable pressure, the mercury would probably also be forced through the pores. The bottom of the cistern is double, the lower part being about one-fifth of the capacity of the upper. This lower part turns on a centre, by which it is attached firmly to the other piece, and when turned to " not portable," as engraved on the brass case, two holes in each part coincide, so as to open a passage between the two divisions, and when turned to " portable" these passages are tightly closed. In constructing the instrument, the tube having been boiled, it is attached to the cistern by cement, the cistern is then filled full of mercury, and the bottom part is then turned to " portable", which closes the apertures of communication, and leaves the part of the cistern with which the tube is connected *perfectly* full of mercury. By a screw hole the mercury in the movable bottom is then allowed to run nearly all out, and,

the screw being replaced, the instrument is finished. The bottom part is then turned to "not portable," and the instrument is set upright. In this position, the air which was in the movable bottom of course passes up through the two apertures, and the mercury descends into the space the air had occupied, thus leaving a part of the upper cistern empty to allow of the descent of the mercury in the tube. The instrument is then compared with a standard barometer, and the scale adjusted so as to shew the proper height. The height of the column indicated at this time is called the "neutral point." When the instrument is prepared for transport, it is first inverted, by which the mercury again fills the vacuum in the top of the tube, and also fills completely the upper part of the cistern, and the bottom being turned to "portable" all motion of the mercury in the tube is prevented. But the consequence is, that no allowance is made for the expansion of the mercury in the tube, and supposing the instrument packed in London at the temperature of 32°, and that on the voyage it was exposed to a temperature of 140 (which is quite probable), the expansion of the mercury in the tube 32 inches long would amount to more than three-tenths of an inch, and the wooden cover of the cistern being nearly 50 times larger than the tube, this expansion of the mercury would act with an *irresistible* force, multiplied 50 times, to force out the cover, or the mercury into its pores. There can be little doubt that the cover, after being exposed to this enormous pressure, would become loose, after which the expansion of the small quantity of air which would get into the cistern after the instrument was exposed to cold again, would be able to force out more mercury from the cistern, an effect which would go on increasing until the instrument was quite destroyed: or if set upright with the movable bottom part turned to "portable," the weight of the mercury in the top of the tube, would exert a pressure increasing as the barometrical pressure at the place decreased, and most likely quite enough to force out more mercury from the loosened joints. Another defect in the instrument arises from the cover of the cistern being made of wood. In the instrument examined, this has shrunk so much, that it is quite loose, so as to afford a very easy escape to the mercury. This part should have been made also of iron, with a small plug of loose grained wood inserted in it. Another imperfection lays in the scale not being connected with the cistern by a brass rod, which it should have been, by which the uncertain longitudinal expansion of the wood mounting would have been counteracted. A very strong corroboration of the remarks of the late Lieut. Braddock on this last imperfection may be seen in the instrument examined. The scale is 14 inches in length, and is attached at each end to the wood mounting by a screw. In consequence of the shrinking in the wood between these points, the scale had bowed out, and the person who had used it had therefore removed the screw at the upper end; and it could be easily seen, from the hole of the screw which was worked into a piece of brass no longer coinciding with the hole in the scale, that the wood within the length of this 14 inches had shrunk in length full one-twentieth of an inch, and therefore the whole instrument has decreased in length one-tenth of an inch—yet the scale very absurdly professes to give the height of the mercury to the 500th part of an inch. I am unable to see any advantage in this plan for a portable barometer, and on the contrary have pointed out undeniable disadvantages.

4. The object to be gained in a portable barometer is principally to prevent the column of mercury striking too heavily against the top of the glass tube, which may, I think, be easily gained, by making the cistern wholly of iron; in the bottom an iron screw may be placed, the point of which has a piece of India rubber attached to it, and which being screwed up will close the bottom of the tube. A very fine capillary passage should be worked down the point of this screw, and out laterally, so as to allow of the *gradual* descent of the mercury, in case the instrument should be placed upright, and also of the expansion in the tube. Such an instrument could only be destroyed by inverting it with a jerk after being held upright.

5. Guy Lussac's plan of the syphon barometer is the best portable instrument I am acquainted with, and I consider the instrument here described as constructed for me by Messrs. W. and J. Jones of Holbourn, London, to be the best adapted for use in India.

6. The case is constructed solely of brass, it is 36½ inches long, and is formed of two brass tubes, about seven hundred parts of an inch in thickness, joined together by a short brass cylinder between them, into which they are both screwed, the upper being seven-tenths of an inch in diameter, and the lower nine. The top and bottom are closed with screwed plugs with rings. In the front and back of each of these tubes, a slit, 9 inches long, and a quarter of an inch wide, is worked, through which the glass tube is visible. On the edges of these slits the divisions are laid off upwards and downwards from a central point. On both the upper and lower tubes, two short thin brass cylinders, each ¾ of an inch long, slide freely. On the lower part of the upper of these pieces, on each tube, a milled ring works in a groove, and the upper part of the other cylinder, having an external screw cut on it, works into an internal screw cut in the brass ring, by which on turning round the milled ring, the lower portion of each of these cylinders is raised or lowered about

three-tenth of an inch, so as to allow of an adjustment in this manner to the upper surface of the mercurial column, as seen through the slit. In each of the lower pieces of these sliding cylinders, a portion is cut out [illegible] an inch long and a ¼ wide. The sides of the notch thus formed coincide with the line of the divisions, and on one of these sides the vernier is cut; the bottom of the lower piece of the sliding cylinder being the bottom of the vernier, and being brought as a tangent to touch the top of the mercury. The back and front part of the bottom of this piece, being both made to apparently touch the mercury, prevent any error from parallax by the uncertain position of the eye in taking the observation.

7. The glass tubes are formed in four parts, the upper is 11 inches long, and at bottom is drawn out into a capillary quill 2 inches long. A piece of tube, of a little larger diameter, and four inches long, is soldered to this tube, above the contraction, so that the capillary quill projects free two inches into the centre of this short piece of tube. To the other end of this short piece is soldered the rest of the tube, which is bent up as usual in syphon barometers, and the recurved end is finished as in Guy Lussac's plan with a small lateral hole, over which a piece of wash leather is tightly bound, or a capillary glass quill 3 inches long is inserted into the end and soldered, and a piece of wash leather is tied over the outer orifice. If the tube is of the latter construction, it is necessary to be careful after setting up the instrument to oscillate the mercury up to the summit of the tube, so as to draw out any small portion of mercury from the quill, which would make the mercurial column stand too high. By the capillary quill in the centre of the tube no portion of air can get into the top, and the tube is in no way affected by any portion of air which may get into the lower part. As thick tubes cannot be soldered together in the above manner, these tubes are necessarily slight, but packing with India rubber, so as to support them closely, for which Messrs. Jones have my directions, they are rendered quite as safe in carriage as any others. The price charged for these instruments by the makers was 7 guineas each, and one very great advantage in them is that fresh tubes can be inserted in a few minutes, which no other kind of portable barometer will admit of.

8. A very great advantage in syphon barometers is that the capillary action of the tubes is neutralized, which, in India, where but few opportunities of comparing barometers occur, is not to be lightly regarded. Experiments have not yet decided what the true capillary action in barometer tubes really is, and in Daniel's Essays it is plainly shown that capillary action in the same tube differs according to circumstances.

9. Daniel has pointed out that many barometers are made and sold in London, the tubes of which are not boiled, and the divisions are laid off by comparison with other instruments. This is also often fraudulently done with instruments for exportation, and when they are made with close cisterns, this fraud is difficult to detect, but in syphon barometers is easily discovered, because the mercury in an unboiled tube will not stand within an inch nearly of its proper altitude, and if the divisions have been laid off from the ends of the mercurial column instead of from a central point, the distance between the divisions, as numbered on the top and bottom parts of the instrument, will not be found to agree. Thus between 7 on the lower part, and 7 on the upper part, should be 14 inches exactly; if it is less, then the instrument has been improperly made.

10. Those who have sufficient mechanical skill and ingenuity to boil the tubes themselves, may provide themselves with instruments like the syphons above described at a much lower price by ordering the brass cases without tubes, and a stock of empty tubes to be sent; for which Messrs. Jones charge only 8 shillings each. These tubes are sent out in two pieces; the recurved part being separated, and to be attached at the lamp. But the method by which I prefer to fit them up, is the following. I bend the end of the long part at right angles, and then cut it off close to the side, so that a piece of 2 or 3 tenths of an inch projects; I then fill the tube with water, and then with mercury, and free the upper part from air, as hereafter described. I then heat the closed end gradually over a chauffer, and make all the moisture simmer up to the open end, carrying the tube gradually across the fire. The closed end is then again heated (the tube being held at an angle of 20 degrees with the horizon), until the mercury first becomes speckled and then forms large bubbles, which by making the tubes revolve, are carried gradually and spirally towards the open end, collecting all the smaller bubbles in their way. The mercury must never be allowed to boil and snap, for if this is allowed, minute portions of gas, hardly visible when cold, are carried down towards the closed end, and cannot be removed except as directed. The gas I consider to be probably hydrogen, evolved from the decomposition of minute organic substances in the tube. I find by frequent experiment that filling the tube first with water is the best method to get all the air out, instead of carefully drying the tube as generally directed. The tube being properly boiled, the part for the recurved end is to be sealed at the lamp, and the end finished as customary by blowing, and then the rounded end of a rod of glass being applied to the side of the tube, ½ an inch from the sealed end, and this being pulled when the

tube is softened, a little cone is easily pulled out. The end of this is to be broken off, and the hole thus made opened and finished, to receive the bent end of the long tube. The two tubes are then tied strongly together with thread, and small pieces of cork between, and then the junction between the tubes is to be made good with sealing wax, and when cold, an inch of mercury being poured into the recurved end, the tube is finished. Two tubes thus constructed, I have found by hourly observations for many days, never to differ one-hundredth part of an inch.

11. But the best and most portable kind of barometer for India, is with tubes to be filled *wet*, they can be carried empty, and therefore are not liable to accident, and when wanted can be filled in five minutes. The late Mr. James Prinsep, in the Journal of the Asiatic Society of Bengal, has pointed out the advantage of this plan, and by frequent experiment, and during long continued series of observations, I find tubes thus filled are perfectly comparable together, and also with boiled tubes; the only precaution necessary is to make the column of mercury touch *the top of the tube* by inclining the instrument about a minute before each observation. To fill tubes thus, I use a little funnel of iron with a small point and capillary tube attached to it. Having filled the tube with mercury, it is to be set upright in some mercury in a cup, on which half an inch of distilled or rain or any clean water has been poured. By raising the end of the tube a little above the mercury, all the mercury in the tube will descend, and its place be supplied with water. The tube is to be then refilled with mercury, and again set up in the cup, and again raised a little, so as to let one inch of water only ascend to the top of the tube. A quantity of air bubbles extracted from the water will ascend into the vacuum, and the column of mercury is to be oscillated to assist their escape. The tube is then to be inclined until it is filled, and the end being closed with the finger, it is to be removed from the cup and inverted. The bubbles of air which had collected in the top of the tube will now ascend to the open end, as also the water which had been exposed in the vacuum. Mercury is then to be poured in until the water has reached the open end, and the tube is then to be set up again in the mercury, and while upright the end is to be closed by the finger, and inverted, by which the rest of the moisture in the bottom of the tube will be exposed to the vacuum; after which the tube is to be again immersed in the mercury in the cup, the vacuum being still preserved with the finger, which is then to be gradually removed. The tube is now to be gradually and very gently inclined until the water touches the top, and it is then to be removed and in-

-verted, when any bubbles of air in the top will ascend to the open end, the water in the tube assisting its escape upwards. The tube is then to be completely filled with mercury, and allowed to stand five minutes, for the mercury to settle down. On setting it up now in the mercury, if the operation has been properly done, it will be found that the mercury will not fall in the tube, unless the tube is jarred heavily against the bottom of the cup, shewing thereby that the air has been completely extracted. Even when dirty, the tubes answer nearly as well when thus filled. Quilled tubes as before described may be thus used, and they are easier freed from air than the common plain tubes. As they are not required to be heated it is unnecessary to solder the parts together, and the upper quilled part may be made only six inches in length, and the lower portion may be joined to the upper by a sealing wax joint. When such tubes are required for high altitudes where the mercurial column is less than 24 inches in length, the lower portion of the tube may be shortened, by cracking off a piece, as it is better to keep the top part as short as possible, it being then most easily freed of air.

12. The instrument which I prefer for measuring the altitude of the mercury is very portable and simple, and Messrs. Jones have the minute directions necessary for making it. The following is a general description of it. It is formed of a solid piece of dry mahogany, 39 inches long, 2 inches wide, and 1½ inches thick—along the centre to within 2 inches of each end, a groove three-quarter inch broad and the same in depth is hollowed out. Across the bottom of this groove a piece of plate glass 1½ inches wide is let in level with the face of the piece of wood. This glass forms the cistern for the bottom of the tube, and allows the surface of the mercury to be distinctly seen. The tube is laid in this groove loosely with cotton, and a flat piece of brass, which turns on a pivot across the top of the groove, keeps it in its place. The wood on the right side of the groove is cut away to allow a brass bar, six-tenth inch wide, and quarter inch thick, and 32 inches long, to be fitted in there. This bar is divided into inches from a standard scale, at a noted temperature, and serves to measure the length of the column. It is not fixed, but can be moved up and down about ¼ inch by an adjusting screw, to allow an ivory point which it bears on its lower end to be brought into exact contact with the surface of the mercury in the cistern. The vernier slides on the upper part of this bar, and has an adjusting screw also. The tongue attached to the vernier turns on a hinge joint to give room for putting in the tube. A cover, formed of a piece of mahogany of the same length and breadth, and ½ inch thick, is

attached to the left side of the instrument by three hinges, and closes by 3 hooks and a small lock and key. Hollows cut out in the cover admit the heads of the adjusting screws, and in it are also imbedded a small delicate thermometer, a hook with a conical screw, to screw into a tree or post, to hang the instrument on, and an ivory plate with the aqueous tension in inches engraved on it from 32° to 120° of Fahrenheits. A brass swivel ring attached to the top screw serves to hang the instrument up by.

13. To take an observation the tube is filled as directed above, and the case being held by an assistant to an angle of 45° with the lower end over a plate, or handkerchief on the ground, the cistern is filled with mercury until it runs over. In this the end of the tube is immersed while closed with the finger, and it is then laid in the groove, the securing piece of brass turned down, and the instrument held vertical, the surplus mercury in the cistern running over into the plate or handkerchief. The bar is then screwed up as far as it will move, and some of the mercury in the cistern, is allowed to run out, by a little channel through the wood, which is stopped by an ivory pin; until the end of the ivory pin attached to the bar becomes visible (which projects about six-tenth inches below the edge of the glass plate). The point is then brought into exact contact with the mercury in the cistern by the adjusting screw, and the height read off by the vernier. As tubes ⅓ an inch diameter in the upper part, can be used in this manner, the effect of capillary attraction is avoided, and the length of the mercurial column, added to the aqueous tension for the temperature, gives the correct pressure, with a degree of precision never exceeded in portable barometers, and comparable even with the best standard instruments.

14. In publishing barometrical observations, whether for altitudes or for a series of meteorological observations, observers should be always careful to describe their instruments, and to give certain evidence of their being in good order. For want of this many series of observations recorded, are hardly worth the trouble of making them; and it must be recollected, that having compared a barometer at one time with a standard instrument, is no proof of its being in good order at another. It might seem to some that the last remark was somewhat gratuitous, but in turning over some recorded meteorological observations, I find a gentleman remarking that his barometer "had been compared with Mr. Prinsep's standards, and had proved correct, and that it had *since* been *emptied, and the mercury purified*"—which is almost as much as to say that his observations were worth nothing, although Sir John Herschel in remarking on them was too polite to say so. In general

a single tube baremeter is useless for nice observations, unless it has been compared with another, even if it is in good order, for the capillary action in the tube *can never be valued* unless by comparison with a barometer which can be depended on. The double syphon tubes I have above remarked are free from this defect, but whatever the construction may be, the mercury in a good boiled tube must be free from specks or cloudiness throughout its whole length; and it must *jar* against the top of the tube (not *bump*), as a bar of steel might be supposed to do.

15. Since the above was written, I have had the opportunity of examining another of Newman's barometers, like that described in para. 3, and I found the lid or cover of the cistern so shrunk and loose, that nearly all the mercury had escaped, and also that the tube had been attached to the cover by glue and tow, which, in the damp weather in this climate, had been softened so much, that the mercury had been forced completely through the joint. As there are many of these instruments in India, the following directions regarding them may be useful.

16. Whenever any mercury has been found to have escaped into the case of the instrument, it may be generally considered as certain, that it has become useless until put again into order, and it should in consequence be carefully kept with the cistern upwards, because if set upright, some air might get into the tube, and render necessary the trouble of reboiling the tube. The brass ring at the bottom of these instruments has 6 brass screws in it; the three nearest the wood attach the ring to the wood, the lower three screws are screwed into the wooden lid of the cistern. In the lower piece of brass by which the bottom of the cistern is turned, there are two iron screws, which open into the cavity of the cistern; care must be therefore taken that they are never taken out except when necessary to take the instrument to pieces. The three brass screws which hold the cover of the cistern being removed, the part of the cistern which is movable being pulled, the cistern and tube will come out easily, but great care must be taken not to turn it round in the least, which would snap off the little thermometer. To put a barometer of this kind in order, if any air has got into the tube, the first thing to do, will be to ascertain if the lid of the cistern is tight. The two iron screws in the movable bottom piece being removed, the brass cap may be pulled off easily, and the cistern and tube, can be filled with mercury through the holes. The cistern being quite full, the tube is to be held downwards, and the bottom of the cistern turned round a quarter turn. The tube is then set up in an erect position, and on jerking it slightly up and down, if the lid of the cistern is loose, the mercury will

spurt out in radiating streams, all round the juncture with the cistern. To remove the cistern, a small iron screw in the edge of it must be sought for and removed, and it can then be screwed off the cover. To remove the cover of the cistern from the tube, it must be soaked for a day or two in water at 140 deg. Farhenheit (hotter would break the thermometer), which will soften the glue, and the tube and thermometer must both be pulled out. The interior of the tube must then be washed quite clean by filling it with distilled water, and emptying it again several times. Generally a little dust of black oxide of mercury will be found in it, which must be removed by dropping some nitric acid into it, and washing out again with water. The tube is then to be filled wet with mercury, and freed from air, as directed in para 11, and then boiled. To cement the cover of the cistern on to the tube again, both the tube and the cover being made hot, some sealing wax is to be applied around the tube, and the cover is to be twisted on, while the wax is still soft. The cistern is to be cemented also on to the cover, by heating it strongly over a charcoal fire until it is hot enough to melt sealing wax, and some wax softened in the candle being applied all round inside the screw, the cistern being held by a thick cloth is to be quickly screwed again on to the cover. When all is cold, the hole for the thermometer is to be closed by a piece of soft wood, and the cistern being filled with mercury through the two screw holes, the bottom is to be turned, and the surplus mercury in the bottom is to be allowed to run out. The screws having been inserted, the bottom is to be turned again until the mark on the two pieces shews that the openings coincide, and the tube is to be held upright. The next thing is to insert the thermometer, which is now to be put into its place and cemented with some putty made by rubbing chalk fine with wood oil, which will dry in a couple of days. But as the thermometer is of no use, as it will not shew the temperature of the mercury in the tube, where all the hottest mercury of course ascends, it is better to remove it altogether, and to stop the hole tightly with a deal peg. A thermometer attached as in these instruments, is the more inconvenient, because very liable to be broken, and then of course might endanger the whole instrument by letting the mercury out of the cistern. To finish the barometer, nothing more is afterwards necessary but to adjust to its old neutral point, by comparison with a good barometer, by adding or removing a little of the mercury in the cistern by the screw holes.

V.—*Account of the Basava Puran;—the principal Book used as a religious Code by the Jangams.—By* C. P. BROWN, *Esq.*

The description of the JANGAMS, given in a former essay, may shew how far these Vira Saivas differ in their creed from the other Hindus. To render the view of their state more complete, a sketch of their popular literature may be advantageous. Legendary lore is puerile enough in all countries; and is not worse in India than that which prevailed in Europe, before the invention of printing. That of the Jangams deserves notice, because forming the creed of a large body of Hindus, who venerate the BASAVA PURAN as sincerely as Bramins do the Ramayan.

The *Puran* or legend of Basava was originally composed in the Telugu language by Palacuriki Somanatha, who likewise translated the *Pandit Aradhya Charitra* from the Carnataca language. This poet lived in the days of Pratapa Deva Rayalu, also called Praudha Rayalu, who appears to have ruled the Telugu country from A. D. 1456 to 1477.* That the poet was cotemporary with this prince is stated in the introduction to the moderuized (padya metre) version of the Puran, written by Piduparti Somaia.

That introduction further states that the "Charitra" was versified (written in padyams) by Sri Natha, the well known poet who translated the Naishadham into Telugu.† Indeed the antiquated style in which the Puran and Charitra were originally composed, is (though still extremely popular) so rude and inelegant that modern poets have rewritten these works, as Dryden and Pope have remodelled the poems of Chaucer and Donne.

After Somaia had translated the Puran into *padyams*, he proceeded to translate the Lila from Carnataca verse into Telugu dwipada. His uncle Basavaya had already written a *padya* version of the Lila; as also of the *Dixa Bodha*, the *Pilla Nayanar Catha* and the *Bramhottara Khandam*. None of these works equal in beauty of style the *Puran* and *Lila* in the *modern* version, written (perhaps about A. D. 1600) by Somaia. Hindus are always apt to give a fictitious antiquity to their favourite authors: and late enquiries have shewn me that the dates mentioned in a former essay require correction.

Some of the more popular legends are contained in books which are considered *Purva Saiva* or braminical; such as the story of Bhallana, that of "Chennappa the savage," and a few others; which are given not only in the Basava Puran but likewise in the *Sri Calahasti Mahatmyam*, in the *Vaijayanti Vilasam*, the *Vira Bhadra Vijayam*, the *Raja Sekhara Charitra*, and some other Canarese and Telugu books, not written by Jangams but by Bramins; and accordingly dedicated not to Basava but to Ganesa or Rama.

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* See the chronological series of kings, framed by Col. Mackenzie, and printed in Mr. Campbell's Telugu Grammar.—See also note at end of this article.

† I have not succeeded in obtaining Sri Natha's version: but have in my possession all the other volumes here named.

These legends, again, are distinct from those (now wholly obsolete) which are given in the Siva Puran and Linga Puran: of these a summary may be seen in the preface to Professor Wilson's translation of the Vishnu Puran. Here, as also in his "Two Lectures" (lately re-printed at Madras*), the learned professor points out that "the wise look upon "the outward emblem as nothing; and contemplate in their minds the "invisible inscrutable type; which is Siva himself. Whatever may have "been the origin of this form of worship in India, the notions upon "which it was founded, according to the impure fancies of European "writers are not to be traced in even the Saiva Puranas."

The *Siddhānta Sékharam*, the *Siva Siddhanta Tantram*, and the *Suprabhéd Agamam* do indeed describe the lingam; but these are *braminical* treatises of modern days, written in Sanscrit. In the *Tantras*, of which an outline may be seen in Professor Wilson's Two Lectures (as also in my former essay), there is not the slightest allusion to the lingam. In the books now to be described, all the legends inculcate devotion to this image of Siva: but regarding the image, or its origin, there is not a single syllable.

The *Purva Saiva* being the *ancient* or braminical creed, offers homage to the image placed in a pagoda or in any sacred situation. The Jangama or *Vira Saiva* is the modern anti-braminical creed,† wherein each individual wears the image. The ancient form directs pilgrimage, penance and sacrifice: the modern substitutes (Guru, Linga, Jangam) devotion to the teacher, adoration of the image, and benevolence to the fellow worshipper. The older form admits of caste, and considers Bramins as sacred. The modern rejects caste, and certainly teaches no veneration for Bramins. In the modern creed every homage is paid to *Basava*, and paid exclusively to him as *Siva*: paying no regard to Parvati, to Ganésa, to Nandi, or any other attendant on Siva: in the older or braminical system (such as is taught in the Calahasti Mahatmyam and other books named with it) the name of Basava is never mentioned.

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* On sale at the Athenæum Library.

† Opposing the braminical superstitious as vehemently as the *Wahabi* creed opposes the older Musulman sects.

The Basava Puran is in seven books, containing (in the original Telugu dwipada) 12,700 lines; it is an evident imitation, in some points, of the braminical puranas; for instance, the introduction declares that to pronounce the three syllables *Ba-sa-va*, and the syllables *Gu-ru*, is a means of obtaining heaven: and that faith (bhacti) is the great foundation of good. The book purports to be a series of legends regarding various devotees (bhactulu) or zealots who attained *faith*; and details the miracles performed by these "worthies." These (in imitation of the bramiuical mode) are narrated by the god Siva to his wife Parvati and the sage Narada. The book opens with homage paid by Siva to Basava, who is declared to be an incarnation of Nandi (the Apis or sacred bull): and a few of the latter legends are concerning this confessor (Guru) Basavesa, closing with his death; but the greater number of the stories have nothing to do with Basava, and merely describe the devotion of various saints, who lived in ages previous to his birth. These are introduced as being narrated by Basava, or in his presence. The first book describes Basava's parentage and birth as given in the former essay; and then gives the following details.

In his eighth year his supposed father, being a Bramin, wished to invest him as usual with the braminical thread: appointing him a (guru) confessor or teacher. But Basava replied the great Siva is my teacher, and I desire no other. The father tried to persuade him that the *Bramhachari* state, into which this rite introduces children is itself emblematic of Siva. These words greatly offended Basava, who replied "you "speak of ordinary braminism and faith (bhacti), as if they were one and "the same: whereas the *yajna* rites declare bramanism and faith to be "quite distinct. There is no specific form of God as a visible shape: "he is dead in his works who believes that the deity can dwell in a specific form. None can attain eternal happiness unless he meditates on "the (lingam) image, using the six-syllabled spell (Om Namasivaya) "with adoration, and the rosary (rudrāxa) and ashes. Further, divine "bliss (linga-para-saukhyam) has not been expounded even in the "Vedas. Some assert that a religious profession (brāmhanyam) and "faith (bhacti) and spiritual intelligence (darsanam) are all one; but "profession exists merely in the homage paid to gods, &c. and he who "thus is tied to works has not faith. There is a wide distinction between profession (āchāram) and faith. Faith in the god is the honourable wife: whereas profession is the (jāra-strī) harlot. Consider "that Brahmins, when invested with the thread commence the rite with

One of these is a pious woman who ponders how it should happen that Siva should have every relation excepting a mother.* She reflected on the grief she suffered at the loss of her own mother; and, imagining it might comfort him, she longed and prayed to become his mother. She thereupon adopts a boy; but, to try her faith he occasionally abstains† from the breast as a fast. She imagines the boy to be unwell, and as he will not tell what ails him, she is about to knock her brains out (as usual in these fables) when he bursts out in divine form as Siva: and offers to grant her every wish. She makes no request and he bestows on her (sayujiam) eternal happiness: and she is now worshipped as saint Ammavva: having been a mother (amma) to Siva.

A man and his wife who daily offered boiled milk to Siva leave home, directing their daughter to attend the god daily. She one day put the milk before him, and bowed to him as she left him to drink. On her return, she finds he had not drunk it. She begs to know what had offended him: as he remains silent she offers (as usual) to knock her head against the wall; but the god took pity on her and drank the milk. This he continued to do daily until it happened that on coming out she met her parents who asked her for the milk in the vessel. She alleged that the idol had drunk it. This they disbelieved as he did not eat what *they* offered. They therefore took the girl to the image to repeat the story to him. She bowed to the figure who opened his bosom; she entered and the marble closed again. Her father caught her by the hair; which therefore did not enter, and still continues to grow! so that they keep it cropped.‡ Could you desire proof more complete of any miracle?

The next legends are yet more marvellous: but they certainly have this negative merit, that they are free from the foulness of the braminical legends, and we find none of the curses therein inflicted, as absurd as they are cruel.

Some of the tales are merely ludicrous. Thus one of these simpletons sees a statue of Siva dancing. He imagines the god is contorted with rheumatism. The story ends as usual by the god carrying his worshipper to (Cailas) Olympus.

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* Compare the Legend of Saint Kentigern, as narrated in the second volume of Southey's *Sir Thomas More; or, Colloquies on the Progress and Prospects of Society.* There we even find the story of a fox or wolf used in lieu of a horse.

† Like Saint Nicholas, the patron of thieves, who is noticed at a subsequent page. When an infant at the breast he fasted on Wednesdays and Fridays.

‡ There is a similar story regarding St. Francis. Compare also Napier's Lights and Shades of Military Life, 1840, vol. 2. p. 87, the story of a crucifix, the nails of which they are obliged to cut from time to time.

The next legend is that of "Cannappa the (boya) savage." This story is remarkably popular; it is narrated in various books: and many Hindus at this day are named after this worthy. In the *Sri Calahasti Mahatmyam* the story is given in great detail, but may be summed up briefly. Cannappa (who is one of the *silly saints*) is a forester, who in a dream beholds Siva in the form of a hermit: and is directed to plunge into the forest to seek the god. He next day pursues a wild hog into the wood; where it vanishes and he finds an image of the lingam. Here the god appears to him: the lad recognizing him, invites the god home. The god was silent, and Cannappa imagined this might be the effect of hunger: so he went to bring him venison. Another story is here introduced to shew how the giants turned themselves into wild animals, in the hope that being slain by the blessed hand of Cannappa they should obtain (moxam) heaven. Cannappa now daily brought flesh of wild hogs and deer with which he fed the god: but a Bramin hermit who lived near the spot was offended that Cannapa, being a pariar or outcast should thus gain the favour of Siva, while he himself daily exercised an unprofitable devotion and offered fruits and milk to the image. Here the Bramin introduces the following story. Once upon a time, a devout spider[*] built her web so as to shade the image; which a devout but jealous elephant tore down and daily bathed the god: which he supposed to be a more acceptable homage: but the spider became a snake and got into his trunk and killed him. Now I, a weak Bramin must thus contrive by cunning to kill this brawny forester. While he thus plotted, the god determined to put the forester's faith to proof. There was as usual a single eye painted on the image. From this eye Cannappa perceived tears were flowing: which he wiped away with his shoe; and then filled his mouth with water which he spirted over the image, which now poured forth a stream of tears. He begged to know what was the matter, *whether the god was in want of food for his wife and children.* Perhaps, said he, you want another eye: if so take one of mine! so saying he pulled out one eye and presented it: but the image still wept: so he pulled out his other eye. Whereupon the god appeared in his true form and restored his eyes.[†]

The poet now proceeds to extol this saint, declaring that *to be touched by the spittle, and the shoe of this saint was no small honour to Siva.*

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[*] In this legend Sri is asserted to be a Sanscrit word for a spider; a meaning found in no lexicon.

[†] Compare the legend of Saint *Lucia* at *Naples*, who in like manner tore out her eyes, and had them restored.

And as a satisfactory proof of this story he refers us to the temple at Calahasti, where the image of Cannappa stands facing the image of Siva. There they *first make offerings to the saint* and then *give the leavings* to Siva: they *rinse the mouth of the saint*, and then present this as *holy water* to the god!

This concludes the eight legends of the "childish devotees;" and they are not represented as followers of Basava, who was born in a later age.

The *Sri Calahasti* legend (a separate poem in four books, translated from Tamil) gives this story with the additions that the *spider*, *snake*, and *elephant* (*sri*—and *cala*—and *hasti*) mentioned in this story were adopted by Siva as his devout servants.

The next legend is remarkably popular, and has furnished the theme of several poems. It is the Legend of Sri Sailam, a pagoda on the river Krishna in Curnool: described by Colonel Mackenzie in the 5th vol. of the Asiatic Researches.

A baron named Sacal Esa Madiraz ruled the town of Nambi: he was a great musician, and devoted his talents to the praise of Siva. Paying a visit to *Mallarusu*, a saint who lived at Sri Sailam, he admired that sacred hill: and particularly the *quaking* or *dancing* hillocks: [here is given a long description of Sri Sailam]. It is here stated that Mallarusu was in fact Mallic Arjuna: a personification of Iswara: and to try the faith of his visitor, the god assumed a strange shape, wherein neither his head nor his feet were visible. The pious Madiraz adored him as incomprehensible. The god was well pleased and brought him into his temple where he invested him with the *image*, and told him that as long as he dwelt on earth he must be subject to the (carma canda) law of works. But Madiraz refused to return to earth, and thereupon the god caused a *tumma* tree to spring from the soil, and under it he directed him to dwell. While he lodged there the god again approached him in the guise of a herdsman, and began to hew down the bough that gave him shade, while he sat at his devotions. Madiraz was angry and forbade him to commit such a sin. The swain replied, thy being angry is a sin, for he who gives way to anger is a sinner. If this annoys you, you may go and seat yourself elsewhere. Have you never heard the adage of the flood, at which a bear came swimming down the stream? a man thought it was a sheep, and in attempting to catch it, he was seized by the bear. Thus you sit here in the hope of vanquishing (maya) the earthly passions, and are yourself within their power, as the man was seized by the bear.

Madiraz, however, persisted in reviling him: while he replied by preaching patience: at last the god blazed forth undisguised. Thereupon Madiraz entreats to know how eternal happiness was to be attained: and is answered that he must again descend to earth; that at present there was on earth the great saint Basava; and, said he, go and listen to his preaching, and I will shortly summon thee to this place. Go now to the city of Calyanam, where thou shalt find Basava.

On hearing these words the saint saluted the god, and the next moment found himself at Calyanam: where Basava had by a dream been warned of his approach and received him with honour. This closes the third book.

The fourth book contains the life of a celebrated saint named Madirāla Māçaiia, who was a washerman by trade, and one of Basava's earliest proselytes. He performs great miracles; a touch of his hand slays an elephant; and a second touch revives him. This man and other devotees lay themselves under a vow to cherish or aid the Jangams in some specific mode, such as washing, making clothes or shoes, &c. for them. A variety of such stories are here inserted as being related by Maçaya to Basava. One saint receives a sack of corn from a woman: at his touch they vanish, and at the same moment all the wealth of the sender disappears; this being intended as a punishment for her feeling pride, at making so liberal a donation. Another saint is gifted with Siva's eye (as destructive as that of the *caliph Vathek*), and entering a Vishnu temple, he *consumes* the luckless *statue* of the god! Another devotee named Chiri Tondan Ambi is extolled as having, with his wife, hospitably received Siva (disguised as a Jangam) and at his desire *to be feasted on human flesh*, he and his wife *roast their son* for dinner. On sitting down to table the god desires them to call their child to dinner. On being called the boy re-appears alive.* Hereupon the god shines forth and carries the whole party home with him to Cailasa.

It is believed that this Tondan Ambi was in this manner carried seven times to Cailasa from Canchi: and is to repeat the journey once more at some future period.

The next legends are equally wild. Narasinga Nayanar was king of the Chola country: his wife one day went to worship at the pagoda, and happened to smell to one of the flowers, which were to be presented to the god: whereupon the priest cut her nose off. Her husband approved and cut her hands off. Whereupon Siva blazed forth, restored his wife her limbs, and carried the pair to Cailas.

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* Saint Servan performed a similar miracle on a pig: as is narrated in the life of Saint Kentigern.

There are several stories to show how Siva was born in various places as the son of various devout women. This appears to be a mode of stating that their sons were pious men.

Several of these saints vitiate their sacrifices by a feeling of pride : whereupon they are punished in various modes.

The next story is regarding Miru Mindu Nainar whose faith exalted him so greatly that Siva (by the name Vālmīk-esa) became his servant; nay his slave, and pander. The other devotees hereupon curse both the god and his pet as equally infamous. " At these words the god was so " frightened that he fled and took his pet with him : they stole round " the idol, and passing under its front they ran away into the jungle." Siva's follower *Nandi* expressed his wonder that a god should suffer such distress : but Siva replies, " I and my followers are one : nor can I be free from grief while they suffer. Indeed on a former occasion, when a devout woman was ordered by the king to produce a militia man, as the fee on her land, I myself went and served* as a soldier furnished by her." This " shews the wonderful power of faith : the good deeds of a former birth would never suffice to obtain such a boon. Wert not thou proud, O Nandi thou wouldst attain *oneness* with me."

Here Basava is informed that Nandi ultimately became thoroughly humble ; and this gained him the honour of canonization.

" And next to faith, charity is the great means : for example this Nambi after bestowing all he had on the poor, proposed even to bestow his body in alms. He began by cutting off his hand : whereupon he was at once borne to Cailasa."

To this succeeds a series of miraculous stories, inculcating bountifulness to the poor : some devotees after reducing themselves to poverty attempt suicide : whereupon they are as usual carried to Cailasa. Several of these tales are interesting, but they are very long. One of these men is visited by Siva disguised as a Sudra who refuses to honour the god adored by his Jangam host : the zeal of the host is aroused and he attempts to slay his guest, who thereupon displays his real form and carries the zealot to Cailasa.

The narrative concludes with the moral that faith avails nothing if clogged with pride. Pride ruined all the pious acts of Nambi, who therefore long lingered on earth.

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* Parallel to the Romish legend of the Virgin Mary, taking the place and doing the duty of a devout nun who eloped for a period from the convent.

The book closes with praise of Basava as being really the god Siva.

The fifth book commences with the life of a very celebrated saint, Kinnara Bramhaya (or, Bramhaya *of the harp*). He distributed all his goods among the Jangams and then lived as a harper. Hearing of Basava's liberality to all the worshippers of Siva he resorted to him. After dwelling with him for some time Bramhaya one day saw a (vitara) gallant carrying a sheep to his mistress. The sheep escaped and ran into the temple of Siva. Bramhaya begged it might be spared, on the plea that it had thus offered itself for sacrifice : so he offered to pay for it : the price being half a (varaha) pagoda : but the man demanded 2,000 pagodas for it. This money he obtained and paid. The man then got two other sheep for the woman ; but she chose to demand the original sheep alone. He therefore attempted to wrest the sheep from Bramhaya who in the struggle cut off the man's head. His relations complained to king Bizzala, who sent for his minister (Basava) and reproached him with the deeds of his fellow zealots. Basava recommended an enquiry into the circumstances on the spot. The king therefore repaired to the place, and the god was called on to bear witness. Siva thereupon burst forth in divine form in flames and thunder, which ceased at their entreaty : the king then offered homage to Bramhaya who consented to restore the dead man to life.

The next four legends are full of miracles, but they are not so popular as to call for notice. We may remark that in these stories Basava is by no means exalted over his brother zealots. It is stated that (on visiting a very charitable woodman, named Moliga Maraia) Basava looked upon himself as sanctified by eating in the house of so excellent a person ; he even envied the birds and beasts that were at this holy abode. On Basava's offering homage to Maraia, he replies by attributing divine honours to Basava, saying all I do is by thy grace: Basava is much shocked at this homage, and replies, have mercy on me a poor inferior creature : as far beneath thee as a crow is beneath an eagle ; for I am the very abode of all sin.*

The next legend is regarding Cannada Bramhaya, a saint of a singular temperament, being (like saint Nicholas) by trade a housebreaker. If on breaking into a house he found that the inmates were worshippers of Siva, he spared them, but shewed no such delicacy towards those as were not of the true faith. He once was digging through the wall of king Bizzala's treasury, and on entering he met Basava, who being the treahim, but removes a hump from his back. (This is one of the legends told in the Socca-Natha Lila, or, Madhura Puran).

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* His crossing the river dryshod is another incident paralleled in the legend of Saint Kentigern.

The Jainas having declared they would acknowledge no proof save that by fire, the Bramin now wrote a Siva spell, and cast it into the flames with a Jaina spell: the Jaina incantation is burnt, and the other is preserved. The Jainas now propose the water ordeal: and the writings of both creeds are cast into the Cavary; in this also their books perished, and the Saiva books floated.

The Siva disputant, who is named Pilla Nainar, now set up a number of iron spikes on which he impaled the Jainas. This persecution is countenanced by a king. Another account in the next page states that the Jainas were saved because they embraced the Saiva creed.

These stories regarding the Saivas and Jainas, appertain to an age previous to that of Basava.

The same narrator adds the following legend. There was a faithful devotee named Nami Nandi, who used to collect *ghee* (butter) as alms, wherewith he lighted lamps in the temple of Siva. The Jainas opposed him, and as he could get no oil he complained to Siva, using the common threat of suicide. The god thereupon appeared to him, and desired him to fill the lamps with water which burnt remarkably well. Then the god smote all the cattle that supplied the oil butter: and the people humbling themselves before Nami Nandi, the saint restored their cattle to life—and they embraced the Saiva creed.

Another saint named Sankhya Tonda, lived in the Chola country: he was the son of a Buddhist, and as he could no where find men who adored Siva, he prayed his god to destroy all the Jainas; and, added he, until thou grantest this prayer, I will daily fling three stones at thee. At last Siva appeared, stretched out his arms, embraced him and granted his prayer by destroying all the Jainas in the town.

The next legend is of a saint named Covvuri Brambaya, who held discussions with the Jains, and as they demanded a miracle, that of reviving a tree from its ashes, he accepted the challenge, and this convinced them.

There was a Jain guru, who was the confessor to a petty prince or baron named Desinga Ballahu. But his wife Suggalavva, had a Saiva named Devara Dasaya as her spiritual guide. She requested him to destroy all the Jainas. But the Jins* slandered him to the king, who counselled her that it was very wrong for a husband and wife to have separate confessors. She was offended and replied that a penitent is just as strongly bound to the confessor (guru) as a wife is to her husband. She reminded him that this was stipulated at the time of their marriage: and it would be better that they should separate than break that promise. Assemble your Jins, said she, and let them dispute with my confessor, and let the termination of the dispute decide our creed. This debate took place. Devara Dasaya asserted that the deity (Siva) pervaded all the universe. They replied, if your god fills all space, it surely is superfluous to assemble in temples to adore him. Dasaya replied:—" The king rules the whole country, but it does not hence follow that every one of his subjects is king. There is no occasion to attend temples as the deity is present with us all. Consider, the Chandra canta stone (seleuites, amber) has the lunar influence inherent, and melts at the lunar ray; so does the heart of the pious man melt at the divine influence: for in him the deity is inherent. If we desire to have the milk of the cow we must buy the calf too: for it alone influences the udder to flow: thus none but the faithful adorer can derive any good from worship. The pearl shell rejects all common rain and is impregnated with pearls only by the genial showers of (Swati) the asterism Arcturus. In like manner the faithful Vira Saiva's heart expands to the influence of Siva alone."

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* Jina or Jina Deva, is the name used for the deity by the people who call themselves Jins, or Jainas.

They then asked whether Siva was the body or the soul of the world. He replied " Life and its properties do not appertain to the divine being. The living soul is in bondage to works but the deity acts from will alone. The deity is in our bodies, latent, as fire is in wood or oil in seeds: coexistent and hidden."

They replied saying, you say that Siva fills all space, and add that the divine influence is immortal: while the vital spark is mortal. This should be proved. Besides there must be one common principle of life extending from brutes up to deity. Explain this.

He replied, oil exists in linseed though it is imperceptible.* The deity shall be attained by the wise, no fool can attain to him for he pervades all nature. Of this I will convince you by destroying this Jaina town (a town named Potla Cheruva) and as a mark of my power, said he, tell me what is in this jar—verily the deity is therein. So saying he produed a jar containing a snake: and on opening it the snake was found metamorphosed into a crystal (lingam) image. This convinced his opponents. He then pulled down all the Jaina temples and set up this image to be worshipped under the name Uttar Eswara.

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* I omit some further argumentation, which is tedious, and just as inconclusive as the above.

The next legend is similar: describing the setting up of Saiva images in Jaina temples. The next is yet wilder. The Jainas delude a Saivite who is blind, into one of their temples and setting his face towards (Jin-eswara) their idol, assure him it is (a lingam) an image of Siva: he worships it: whereupon the Jaina image burst to pieces and in its stead there appeared the image of Siva.

The prince Bizzala (who employed Basava as his minister) now opposes the Jangam faith; being himself a Jain. On one occasion he sets up an image of the god Gopala [this is the name of a braminical god: but it is stated that this was done merely to annoy the Virasaivas]. He desired all people to worship this image. A zealot named Bāçayya refuses to obey. The king complains of this: but Basava interpose stating that if Bāsaya neglected his duties he merited punishment but he could not be expected to honour a new god.

The next legend (told in the braminical puranas likewise) is that of Bhringi, and deserves notice (though pitiably silly) merely because very popular. This Bhringi was a devout servant of Siva (Jupiter) on Kailasa (Olympus) and wished to honour Siva in the rite called *praduxanam* (encircling him, circumambulation). But he declined paying any homage to Parvati (Juno) and as Siva was in the (Arddha-nari) hermaphrodite form* (the right half of his body being male and the left female) Bhringi asummed the form of a (*bhringam*) wasp and bored a passage for himself between these figures: thus excluding Parvati from his homage. The goddess was offended at this and by a curse dried up the zealot's body, abstracting all his flesh and blood, and reducing him to *nobody*. To comfort him Siva presented him with a third leg, and in this reptile shape Bhringi (Tripos tripudians) appears in all the Siva temples, being an especial favourite with the god, and celebrated as a dancer, though a dwarf. Basava tells the king this story to shew the value and potency of faith.

A variety of other legends of miracles may be passed over; as deserving less notice than a dispute regarding the comparative potency of Siva and Krishna, who is the great god of the Bramins. The sermon against Krishna is delivered in the presence of the king by a Jangam named Bachi Devaiia.

Both Krishna, said he, and all the other gods are vastly inferior to Siva. For, were they really mighty how does it happen that they cannot vindicate themselves when misfortunes befal them? Neither Jainas nor Bauddhas worship the true god. Siva alone is supreme.

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* See the prints in Moor's Hindu Pantheon.

This book closes with a violent attack (in 400 lines of verse) on the adorers of Krishna (Vishnu) who is declared to be by their own confession not only a sinner but subject to degradation and death: "Vishnu was finally expelled from earth for his crimes and took refuge in the ocean." Siva is declared to be the supreme being, "one of whose servants would suffice to destroy Vishnu with all his adorers." At the close of this discourse, the prince (Bizzala) renounces the new braminical god (Gopala, or, Krishna) whom he had lately set up.

The seventh and last book (containing more than 2000 lines), describes the homage paid by Basava, as king's minister, to various *pariar*[*] saints who adore Siva. The Bramins complain to the baron (Bizzala) of this conduct: and being summoned, Basava brings the pariar (sitting with him in his palankeen), to the palace. Being therefore excluded, Basava spreads his shawl at the gate and with his pariar friend seats himself on it. The king reproaches him for behaving in this manner, setting at defiance all the rules of caste: and expresses his apprehension that this may bring a curse on the land and heaven may withhold its rain.

Basava replies by telling some stories to prove that pariars are quite as good as Bramins, and that caste itself is a mere braminical device. He states that "the Vedas define but two castes, namely (*pravartica* and *nivartica*) the *active* and the *contemplative*. What avail *castes* recently instituted? Surely faith (bhacti) is the only point in which one man is superior to another. The Bramins here present are totally inferior to this pariar.

Then follow other extravagant stories wherein "the *dog* of a worshipper of Siva is declared as good as any worshipper of Vishnu"—Of a snake that dies as a punishment for biting a Jangam—Of a Jangam girl who considered herself defiled because touched by a Bramin woman: "because touching a Bramin would be a defilement even to the dogs of a Saivite's house. The Bramins are annoyed at being set below dogs, and affirm that at least a dog cannot read the vedas : a Jangam, however, desires his dog to try, and it succeeds very well.

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[*] The word *Pariar* is originally Tamil, *parey*, plural *pareyer*; and signifies *a drummer* (from *parra*, a drum whence parrayan). For the pariahs hold the hereditary village employment of *Toty*, or *Veltiyaun*: answering to the Saxon villein, or serf and one of their stated duties is *to beat the drum* on public occasions. The Spaniards have used this Hindu phrase in South America: where they apply it to labourers and Indians: from Brazil too, they brought the word *peon* which there signifies either a foot soldier, household servant, or a labourer in general.

Besides, Basava assures the baron that in many houses the dogs read the vedas quite as well as their masters. This is not impossible.

A zealot hears a man reading the legends in honour of Vishnu: but avoiding those which speak of Siva. Unable by argument to persuade the reader to do justice to his patron god, he killed him.

A woman who is a leper is driven out of the town by the Bramins: she attempts to visit a Siva temple : the god meets and heals her, and inflicts the leprosy on the Bramins. There follow many more miracles.

Basava's zealous exertions had now encouraged the Saivites to treat the Bramins and their temples with great neglect : and the king receives many complaints that the Jangams were gradually infringing on the rights of all other creeds. Some complaints are made by (boyas) herdsmen : who now lost the dinners (prasadam) which they (as cowherds) had hitherto been used to receive from those who formerly worshipped at the temple of Siva.

On being questioned regarding this by the prince, Basava declares that these men had a claim to the (prasad) blessed food bestowed at the Siva temples, but had no right to enter the houses of Jangams nor even to see their food. The claimants replied that at Casi, Gaya, and Prayaga (the sacred cities), they enjoyed this privilege : and therefore claimed it. He answered that they could claim nothing that is not *offered* at a Siva *temple*. " We of the Vira Saiva sect, he added, will not even tolerate the sight of a Saivite. But, said he, if you choose, you may dine with me to-day on poison ; I shall be happy to see you."—The story ends in Basava eating the poison with impunity, through the power of (prasadam) the benediction which he utters over the food.

Bizzala then looks upon Basava as more mighty than Siva himself, as having swallowed the poison : whereas Siva does not venture to swallow the venom, and merely holds it in his throat. This alludes to a well known story regarding Siva.

On another occasion Basava is invited to dine in company with some Bramins and declines it : because he will not eat with those who neglect to bless the food in the name of Siva.

The next is a story about some cows which are faithful to Siva, and refuse food offered to them by any but Jangams : indeed, they will not eat until they behold the image and make an obeisance to it. " Thus a cow in the house of a devotee has more religion than a Saivite : then how can you be so brutish as to wash the feet of Bramins?"

Another devotee's wife bears him twins: he has provided only one image, which as usual, he hangs at the neck of the first born, and for want of a second he refuses to receive the second infant. This is applauded as a mark of great devotion.

Basava further says to the baron, "How can I convince you of the supremacy of Siva? it is as idle as teaching a blind man what light is. Your conduct is as foolish as using a golden plough, and then sowing thistles. Consider how unavailing were the sacrifices offered to Bramins by Gautama, by Dadhíchi, by Daxa, the emperor Bali and others No honours that you can offer to Bramins can in merit equal worship offered to the (lingam) image."

His friend *Jagad-Eca-malla* is convinced of the folly of adoring Bramins, and offered his thanks to Basava: who now spoke to him in confidence, saying after a short time a dreadful crime will take place here: and you are to slay him who commits it: after which Siva will appear visibly to you.

There were two brothers named Allaiia and Madhupaiia constantly in attendance upon Basava: the baron (Bizzala) caused their eyes to be put out, but Basava and the other worthies restored their sight, after which they blotted out all the accounts kept in the royal treasury. They now sent for Jagadeca Malla, and told him that the appointed time was come for him to slay an offender. Basava now retired from the town, which was immediately filled with outrages, so much so that the devotees fled from it. Malla was appointed to put the baron Bizzala to death but went home without effecting this His mother reproached him for failing to obey the command of Basava. She said, surely had they wished it the worthies were well able to do this themselves: they entrusted it to you merely as a favour conferred on you. If you disobey them I wish you may become a dog and live on (prasadam) rice given as alms.

Hereupon she treated him as a dog, and threw rice on the floor for him to eat. But the other worthies came to console him, and even ate what he left. They then led him to the palace of Bizzala whom these three men slew.* They then returned home, and Malla paid homage to his mother. Then remorse at the crime made them seek to kill themselves, but their god Siva appeared visibly and carried them all to Cailasa.

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* This murder resembles the deed committed in the House of Commons on 30th Dec. 1654 (see Salmon's Chronological History), when a quaker wounded several people declaring that he was inspired to slay every man who sat in that house.

After the death of Bizzala,[*] Basava retired to the pagoda at Cudali Sangaweswaram, and prayed to Siva to take him to himself. Hereupon the god came out of the temple and appeared in visible form, and on being adored by Basava took him to himself (*aikyam*, unitedness, oneness, took place), while the people sung his praise: and thenceforward all the worthies adored Basava as being Siva himself.

The poet concludes by apologizing for the prosaic style in which he has recorded *the History of Basava.*

In a former essay, on the Jangams, it has been shewn that from local records the death of Bizzala appears to have occurred in the saca year 1090 or, A. D. 1168. Dr. Francis Buchanan, however, gives a more remote date (357 years earlier) to the events in question. He states that "in the year Vicrama (3875 of the Kaliyugam), Basava went with his sister to Kalyanam"—and specifies that this corresponds with A. D. 775; and "the time for Basava's remaining on earth terminated in the year Raxasa, 3911 of the Kaliyugam"—adding that this corresponds with A. D. 811: and that Basava's "absorption" or death took place on Wednesday the first of Margarisiras, at 21 hours (ghurries) of the night. Vide Buchanan's Journal in Mysore and Canara, 4to, vol. 3, p. 264.

But this author does not cite proofs of the dates thus minutely specified: and the later calculation (placing the death of Bizzala in A. D. 1168) is more likely to be correct.

Somia of Pidupādu (in his preface to his Padya version of the Puran) states that his ancestor, Somanatha of Palacurru, wrote the dwipada puran in the days of a prince named *Pratapa Rudra.* (This king according to Colonel Mackenzie reigned at Warangole from A. D. 1456 to 1477). And he adds that in those days the fear of the approaching Mahomedan rulers was prevalent. This agrees with the known period of the Mahomedan invasion of Warangole.[†] That puran is written by Somanatha in Telugu: it mentions no earlier poem: and is considered by the Jangams as their most ancient record.

The strong antipathy that exists between the Bramins and the Jangams makes each party avoid mentioning the authors respected by their opponents. This renders a comparison of dates far from easy. The Jaina chronologists mentioned in the former essay have perhaps recorded the true dates of the history: and the precise antiquity of the *puran* is interesting to those who cultivate Telugu literature; because the peculiarities of the dialect give reason to believe it the most ancient existing composition in the language.

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[*] It will be remembered that the *Jaina* account of this murder deviates in several important particulars: and probably is the true account. It is printed by Mr. Elliot in this Journal for 1838, page 212. The miraculous absorption of Basava's body is evidently meant to denote that he was not buried.

[†] See Briggs's Mahomedan Power in India, vol. 2, page 311, date of A. D. 1368 and page 448 of A. D. 1456.

POSTSCRIPT.

Those who wish well to the literature of India will hail with pleasure a notification which appears *in the Foreign Quarterly Review*, regarding a society now founded in London "for the advancement of Oriental Literature *by the publication of the Original Texts.*" With the Earl of Munster as President, and Professor Wilson as Vice President, there is every prospect of its leading to results highly desirable. The *Devanagari* texts may be best published in Bengal or in Europe: that type being foreign to Southern India. But the Telugu, Canarese and Tamil printing (including Sanscrit publications in those alphabets) to be rapidly, cheaply, and correctly executed, should be ordered to be done at Madras and other towns, where we find an abundance of presses well supplied with the requisite types; and where there is no want of skilful compositors who are themselves natives.

As noticed in a former page of this Journal* it is much to be regretted that an ample collection of native literature, more than a thousand volumes, in the Telugu, Tamil and Canarese characters, should be removed from their proper sphere and lie useless in London; part being at the India House and part at the Royal Asiatic Society's Library; while at Madras we often are at a loss for the aid they might afford. In those museums I found some volumes (treated as mere curiosities) which if transferred to Madras might do solid service to Indian history and literature. Regarding remote times, the documents are not wanting: books of a date earlier than the Mahomedan invasion are easily found. But the bigotry of the Mahomedans and the indifference of the English rendered the survival of the more modern native literature precarious, and several works of merit may now depend (as did the writings of Phædrus) on a single manuscript. Because during these ages of neglect a volume however excellent, was but seldom transcribed; and some works have become as scarce as are the MSS. of ARISTOPHANES. Some of these have found their way to England: and as a case in point there is a work (the Parama yoga Vilasam, in Telugn) of which I with much difficulty obtained one copy at Masulipatam: two others (incomplete) have with his usual kindness been transmitted to me by Professor Wilson: and another manuscript I discovered at OXFORD in the BODLEIAN library, whence I yet hope to obtain permission to borrow it. I would willingly transmit a more legible copy along with it in returning the original, which if left to its fate will perhaps before long feast the worms.

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* Madras Journal, No. 26, page 177.

VI.—*On the Structure of the Sevâlik Hills and the Organic Remains found in them.—By* PROBY T. CAUTLEY, ESQ., *Capt. Bengal Artillery, F. G. S.*[*]

The mountains, a part of which I am about to describe, range (with the exception of the debouchures of rivers) almost uninterruptedly from the Sutluj, which separates the territory of the British Government from that of the Sikh chieftain, Runjeet Sing, to the Burhampootur river, and the district of Cooch Behar. Their general bearing, in the portion near the Sutluj, is N. W. and S E; but in that approaching the Burhampootur, it is many points nearer direct east and west. They lie at the foot of the great Himalayan chain, with which they are in some parts connected by a succession of low mountains; but in others, as in the districts under review, they are separated by valleys from three to ten miles in width, and called by the natives Deyra Dhoon, Kearda Dhoon, &c., or the Valley of Deyra, the Valley of Kearda, &c. The highest peaks do not far exceed 3000 feet, and the generality of the summits vary from 2000 to 2500 above the level of the sea. It is necessary, however, to premise, that my observations have not extended further eastward than the Ganges; and that whatever I may record, in this paper, beyond that river, is given on the authority of others.

Between the Ganges and Jumna rivers, this line of mountains is separated from the great chain of the Himalayas by the Dhoon, or valley of Deyra, the average width of which may be under ten miles. At the

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[*] From the *Transactions of the Geological Society of London*, Second Series, vol. 5.

Ganges, or south-eastern extremity, a road passes between the chain and the river; and no difficulty whatever is offered to the approach to the valley. At the opposite or Jumna extremity, on the contrary, the mountains are in many places scarped into the river; and the footpath used by the boat and raft people, is an irregular track, over ridge and through hollow, and impinges upon the river at those points only where the stream, in its meandering course, strikes the opposite side of the channel. The intermediate roads, or ghàts, follow the rivers or hill-streams; for in such an utter confusion of mountains, any other passage is impossible. A few of these roads are passable for wheeled carriages, but the generality are bad footpaths. Between the Jumna and the Sutluj are two other valleys, the Kearda and the Pinjore, separated from each other by one of those complex masses of mountains which connect the lower with the upper Himalaya range. The hills are generally less precipitous in this neighbourhood; and the higher points and ridges are separated by valleys, affording a drainage to the country, and displaying on each side high and beautiful sections of the stratification These valleys, or plateaux—for, with reference to the rivers running below them, they may be considered as such—vary in width, but extend along the whole course of the mountain-streams.

As much confusion may be avoided, in the absence of a native name for the whole range of these mountains between the Sutluj and the Burhampootur, by establishing one, which may be considered legitimate, I wish to propose that of Sevâlik,[*] formerly applied to the portion between the Ganges and the Jumna; a name which appears to me better than that of the "Lower Hills" or the "Sub-Himalayan," terms, equally applicable to the subordinate ranges northwards of the Himalayas.

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[*] In Smith's Exotic Botany, vol. i. p. 9., is the description of the *Rhododendron arboreum:* he refers it "to the mountainous tract called the Sewalic chain, which separates the plains of Hindostan, between 75° and 85° E. long. from the Himalaya mountains. I make the quotation for the value of the name, though the statement is evidently wrong; the rhododendron in question growing in the Himalayas themselves at a high elevation, and in company with oaks. The chain separating the plains of Hindostan from the Himalayas, which is the one now under review, is subject to a mean temperature perfectly inimical to oaks and the *Rhododendron arboreum*. The name is quoted also in Dow's History, and in some traditional writings in the possession of the high priest or Mahant residing at Deyra. The derivation supplied by the high priest is as follows:—

"SEWALIK, a corruption of *Shibwalla*, a name given to the tract of mountains between the Jumna and the Ganges, from having been the residence of Ayshoor Shib, a name of Mahadeo and his son Gun, who, under the form of an elephant, had charge of the westerly portion, from the village of Doodhli to the Jumna; which portion is also called Gungujur (*gujur*, elephant): the portion eastward from Doodhli, or between that village and Hurdwar, is called Deodhar, from its being the especial residence of Deota, or Ayshoor Shib. The whole tract, however, between the Jumna and the Ganges, is called Shibwalla, or the habitation of Shib."

These preliminary observations will make the reader acquainted with the field of our fossil discoveries; and I proceed to the description of the geological features of the tract. The formations composing the hills, consist of beds of boulders or shingle, either loosely mixed or agglutinated by clay and carbonate of lime; of sands of various degrees of consistency; of marl or clay conglomerate;* and of an infinite variety of clays; the two latter being most extensively developed to the westward of the Jumna. The strata dip from 15 to 35 degrees, generally towards the north; and the breadth of the inclined beds is from six to eight miles.

The succession of the strata is irregular, with the exception of the shingle in the more northern tracts, where it appears to overlay as well as to alternate with the sandstones; whereas, although the debris is in considerable abundance in the water-courses, and on the flanks of the hills, I have never met with these shingle-beds south of the most northern half of the hills. A similar remark applies to the marl, but in a contrary direction, as it occurs only to the south. The want of the marl in the northern sections may be accounted for, by suppossing it to have been either a local deposition or a general one, which is not exposed throughout its entire range.

Although I consider the whole of this tract of mountain as composed of one formation, it may be of use to divide the portion between the Jumna and Ganges, from that westward of the former river, as it appears to me, that there is a marked difference (as before stated) in the shingle strata, as well as in the position and number of the clay beds; although perhaps nothing further than would be exhibited on any extended line of country, formed of debris from different tracts of mountains. The causes which upheaved this district, apparently acted more energetically in the contracted surface eastward of the Jumna, than in that to the westward; though, in the latter, the surface upheaved is much more extended. I shall therefore divide these notes into two sections; the first consisting of the tract between the Jumna and Ganges; the second, that westward of the Jumna. To commence, therefore, with the range between the two rivers.

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* I call this stratum clay-conglomerate, the beds being composed of fragments of an indurated clay, cemented together by clay, sand, and carbonate of lime; the clay itself effervescing strongly with acids. The rock is, in general, exceedingly hard and tough, as is shown in those parts where it is in contact with the stream of the rivers, which appear to have had little power upon it.

HILLS BETWEEN THE JUMNA AND GANGES.

Shingle and Sandstone.—The beds of shingle are of enormous thickness, and alternate with the sandstone. The former precisely resemble the shingle in the beds of the existing great rivers of the country, and consist of boulders of granite, gneiss, mica slate, quartz, hornblende schist, and traps; and every other rock, through which these rivers hold their course. If the beds of the Jumna and Ganges were to be upheaved, in the same way as those of former rivers, the appearance of the strata would be exactly similar. The sandstone consists either of grains of pure quartz, with different proportions of mica, or of an admixture of the other ingredients so common in all river sands. The presence of oxyd of iron causes a great variety in colour, from red to gray, whilst the induration of the rock appears to depend on the proportion of carbonate of lime. In the more easterly limit opposite Hurdwar, as well as other places, the stone is quarried for building; and in many localities where it is crystalline, it is highly valuable in architecture. On the Jumna are the remains of an ancient hunting palace, built by the emperor Shah Juhan at the end of the 17th century; and although now in utter ruin, amongst its fragments are capitals of columns, and scolloped arch work, &c. cut in this sandstone, which prove it to be well adapted for architectural purposes. It is easily worked, and the mixture of mica gives two splitting surfaces. On exposure to weather, however, it exfoliates and crumbles, as is conspicuously shown in some lintels, still in position at Badshahmuhul. The colours of the clays are endless; and a light blue variety, which is found under the marl, as well as higher up in the series, where it contains fresh-water shells, is exceedingly pure. The strata of this blue clay are thin, but those of the other varieties are of all dimensions.

Lignite.—Carbonaceous matter occurs throughout the sandstones, either in detached fragments exhibiting vegetable origin, or in strata or seams composed of sandstone and lignite in equal proportions. Lignite is also found in the marl, but generally in the form of black dust; leaving, on its removal, an indistinct, vegetable impression. In one instance, I also met with it in the shingle strata. It has never been found in sufficient abundance to excite an inquiry as to its adaptation for œconomical purposes; though it is common to the whole of this tract of mountains.

Eastward of the Ganges it has been found, to the north of the Moradabad district; and it agrees in every respect with that found elsewhere. It has also been met with at points still more easterly; but the examination of that tract has been very slight. The most interesting point at which I have found lignite, is at the mouth of the Kalowala Pass, one of the entrances into the Deyra Dhoon, from the plains. A stratum or bed of yellow and red sand, about 18 inches thick, is there completely charged with lignite, either in long flattened masses, or in transverse sections of trunks of trees, which show, by their elliptical form, effects of vertical pressure. The lignite, in these cases, constitutes merely the outer covering; the interior of the trunk being composed of the sandstone matrix. The bed is enveloped in strata of the marl, abounding in the remains of animals; and both the lignite bed and the marl, appear at this point most distinctly to have been deposited in a hollow; the beds, at their lateral extremities gradually attenuating, until they meet the sandstone rock; and the lower surface being concave. Although the marl is evidently limited at this spot, it seems to exist so generally in extended strata, that, supposing it to have formed tracts of marsh land, those tracts must have been very extensive. I have before remarked, that I have seen the marl only on the southern limits of these hills, between the Jumna and Ganges. In crossing the former river, however, the same stratum, with the same organic remains, is met with on the north of the mountain ridge, on which the town of Nahun stands. Here the upheavement has been more violent than elsewhere; and the point of junction of this tract with the higher Himalayas is consequently much dislocated. It is necessary to state, that there are appearances of trap* in the neighbourhood of these disturbances; a fact which may lead hereafter to an interesting geological disquisition on the point of junction. Fossil wood, apparently *dicotyledonous*, abounds in the sandstone The woody fibre is generally perfect, but impregnated with the sandstone, and frequently mixed with carbonaceous matter; in which case the fossil is black, and on fracture has the appearance of an intimate mixture of coal and sand, or of an imperfect coal. The only remains of animals yet found are fragments of tortoises.

Marl, with Organic Remains.—As the marl is in greatest abundance in this section, I will now give an account of its organic remains; confining myself to classes and genera. These fossils are in appearance perfect, and the deep black colour which they have derived from hydrate of iron, renders them ornamental. The medullary cavities are, in many cases, filled with pyrites, and in others with pure white crystallized carbonate of lime. The greater part of the fossils, already procured, is from the deposit in the Kalowala Pass; and as my collection is not only large, but abundant in different genera, the number already found in such a limited space, indicates the great variety of animal remains, which a diligent and extensive search may produce. Teeth, and the more solid part of the bones, are found in the greatest quantity. Most of the former are perfect, and as sharp in their outline as when the animals existed; and even in the fragments, the sharpness of the fracture proves, that they were quietly deposited in the sediment in which they are found. The following is a list of the fossils already discovered in the marl:—

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* Dr. Falconer has made the same observation. Journ. Asiatic Soc. Bengal, vol. iv. p. 50; date of communication, 3d January 1835.

MAMMALIA.

Pachydermata	Teeth, and the remains of a species of *Anthracotherium*.
Carnivora	Genera doubtful; but some of the teeth correspond with the third incisor of the bear.
Rodentia	Rat, and a small variety of castor.
Ruminantia	Deer, several varieties, and one molar of a very small species.
Solipeda	Horse, one incisor, and one molar from the right side of the upper jaw: they exhibit a peculiarity in the form of the enamel flexures.

REPTILIA.

Crocodilia	*Ghariál.* (*Gavial* of naturalists.) Teeth and bones in abundance.
	Crocodile. Teeth, in great abundance, fragments of the osseous plates, vertebræ, and other bones.
Chelonia	*Emys.* Fragments of the plates of the back very perfect; also ribs, with the attached osseous part of the buckler.
	Tryonix. Ditto, ditto. Some marked differences in the form and position of the rugous surface of the fragments of the buckler, may hereafter point out a variety of species.

PISCES.

Vertebræ and Scales—The latter doubtful.

TESTACEA.

Bivalve...............Imperfect, but resembling *Unio*. *Univalve :* a cast resembling that of the *Paludina* of the present fresh-water.[*]

Besides these more easily determinable remains, there have been found a number of incisor teeth, which I cannot assign to any genus; also quantities of bones, in fragments, and portions of ribs, one of which must have belonged to a large animal; also vertebræ, matatarsal or carpal bones, &c. With the exception of the teeth, the remains are generally in fragments, and separated; nor does it appear probable that we shall meet with anything approaching to a complete skeleton.

In the tract then between the Jumna and Ganges, the fossil remains as yet discovered are thus disposed :—

Shingle, or Gravel Beds—Lignite, scarce.
Sandstone ....Trunks of dicotyledonous trees in great abundance; lignite, and remains of reptiles.
Marl...........................Remains of mammafers, reptiles, fishes, shells, and lignite.

The mineral products are, carbonate of lime, the general cement of the whole formation, also in stalactites and stalagmites; selenite, in small tabular crystals; and pyrites, but apparently in the neighbourhood of organic remains only. Soda abounds throughout the mountains, efflorescing on the shingle and sandstone rocks; and the presence of this alkali may explain the partial disintegration of the boulders of which the shingle is composed: for, I believe, I am right in asserting, that every variety of boulder, from granite to quartz and sandstones, has been acted on: and when it happens that the boulders can be removed entire from the bed, they fall to pieces, either after exposure to the air for a time, or by pressure of the hand immediately. With regard to fractures in some of the boulders, and their consolidation on different planes, as in a slip of stratification, no remark whatever appears requisite, as these are the necessary consequences of that movement, which raised the beds from their horizontal position. There does not appear to be any further remark necessary on this tract, more than can be reserved for the general summary; I shall therefore proceed to describe the hills westward of the Jumna.

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[*] The only univalve which has been yet found in the marl is the cast above-mentioned, from the rock north of Nahun. I have entered it here, considering, as I do, that the deposits are identical.

HILLS WEST OF THE JUMNA.

These, as I before stated, consist of the same series of shingle, sand, clays, and marls; but they differ, in the beds of shingle being less abundant, although equally inclined, and in containing a different description of boulder. The rolled fragments eastward of the Jumna are all of primary or lower rocks, whilst those to the westward are confined to varieties of clay slate, and quartz The marl, which, between the Jumna and Ganges shows itself in the southern limits, is here exposed at a point north of Nahun, cropping out on the northern slope of the mountain ; and the fossil remains resemble those found in the marl eastward of the Jumna, consisting of mammafers, crocodiles, tortoises, fishes, and shells. From Nahun to the plains there is a succession of sandstones and clays, without any abundance of shingle. The sandstone, which, in the vicinity of Nahun, is much indurated, and used for building, becomes softer on approaching the plains; long before reaching which, the whole formation consists of an interminable succession of sandstones and clays, the latter being in the greatest abundance, of every variety of colour, and dipping, on an average, 20° to the north. The topographical outline of these mountains, shows a considerable southing of upheavement, in the hills westward of the Jumna: and the circumstance of the fossil remains abounding in the sandstones and clays in this tract, and not in that between the Jumna and the Ganges, may probably be due to the non-upheavement of the line on its prolongation eastward of the Jumna. The action, in all probability, was exerted irregularly; and although in the large scale we may lay down the dip and direction with accuracy, the former as varying from 15° to 35°, and the latter from N. E. to S. W., local details give very different results.

The sandstone rock, from which the fossil remains sent to the Society's Museum were extracted, reposes at the above angle, over numberless beds of clays, more or less rich in testaceous remains. The fossil bones lie in great abundance on the surface of the slopes in the neighbourhood of the sandstone, amongst the ruins of fallen cliffs, in the beds of water-courses, &c. The bones which we have had the good fortune to dig out of the rock are perfectly sharp, and in all their original perfection. I may here advert to a circumstance to which the preservation of the water-worn specimens is chiefly due. The sandstone is generally soft, but in the proximity of the fossils it becomes ferruginous, concretionary, and so hard as to turn the edge of the chisel; and thus protects the fossil from destruction in its progress, as a boulder along the torrent's bed. These concretions are occasionally globular, and become singularly conspicuous, by the weathering of some of the ridges, when the mass of rock takes the appearance of huge spherical concretions piled confusedly on each other.

The organic remains of this sandstone yet brought to light, belong to the following classes and genera: most of the species are new; and the appearance of totally undescribed forms will add very considerably to our fossil genera. The new genera themselves will be the subject of separate accounts in their proper place.

MAMMALIA.

Pachydermata...Mastodon—elephant—rhinoceros—hippopotamus—hog.
Carnivora ... ...Canine and feline.
Ruminantia... ...Elk—ox—deer in great varieties.
Solipeda... ... ...Horse.

REPTILIA.

Crocodilia... .....Ghariâl—crocodile; both very closely corresponding with the existing species now in the rivers. Lacertine remains indeterminable.
Chelonia.......Emys and tryonix; some of the fragments are of the most gigantic proportions. Of the smaller varieties, nearly entire specimens have been found; upper buckler and carapax complete. My cabinet also contains three heads, wanting only the occipital portion of the cranium.

PISCES.

Genera not established.

Many other fragments have been found, but so imperfect as to render a classification impossible. I may remark, that there appears to be no end to the variety as well as quantity of these remains; and we may expect to do much, even in this remote region, in advancing the inquiries respecting fossil zoology.

Of each genus above mentioned, with the exception of the horse and the carnivora, I have already almost perfect skulls. The bones of the body, however, appear to have been much broken and mutilated; but it is a singular fact, that from many places where the fossils have been found as mere debris of fallen cliffs, fragments of bone have been obtained, which have admitted of being joined, although the fractured ends were coated with carbonate of lime, as if they had been fossilized separately. A beautiful example of this, is exhibited in an almost perfect rib of an elephant or mastodon, which is forwarded to the Society's Museum, and which consisted of no less than eight pieces. A perfect humerus of a ruminant has been secured in this state ; and the bones of two hind legs, namely, the upper part of the metatarsal connected to the lower portion of the tibia by the intermediate tarsal bones, with, also, the os calcis entire, and all the smaller bones of the tarsus equally so. These remains have belonged to an enormous animal, and, I believe, to the same genus as that of a skull in my possession, and now under description by my friend Dr. Hugh Falconer, of the Bengal medical service, and myself. Although I refrain from zoological details, I must mention, that we have an animal evidently forming a connecting link between the *Pachydermata* and *Ruminantia*, or between the *Tapir* or *Palæotherium*, and the latter order of mammalia. The hippopotamus of this sandstone appears to be a new species, having six incisive teeth, besides other peculiarities, particularly in the proportion of the bones of the head : the tusks also differ from those described by Cuvier in his Ossemens Fossiles. The great depth at which the marl lies beneath the upper strata, with the discovery in it of remains of the horse, is an interesting fact. In the sandstone strata the remains of the horse are by no means scarce. There appears, however, to be a local disposition in the deposits of these remains. In some places the hippopotamus, elephant, mastodon, crocodile, tortoise, &c., are found in abundance, with the remains of ruminants; in others the hippopotamus and the water reptiles are almost totally absent, and only the remains of ruminants and carnivora occur; all tending to prove that these animals were destroyed on the site of their habitats ; and that this former world was not more mysterious than the present; that there were vast tracts of marsh and river, with their attendant hippopotami and crocodiles in the waters, and elephants and mastodons in the neighbourhood ; and that there were other tracts free from water and marsh, and frequented by their natural inhabitants, ruminants, carnivora, &c.

Dr. Falconer, in a note read at a meeting of the Asiatic Society of Calcutta[*], suggested the identity of this deposit with that near Prome, some of the fossils from which have been so beautifully lithographed in the Society's Transactions[†]. The mastodons in the Sevâlik strata are in great abundance ; and as we have perfect skulls, we are enabled to form some opinion of the dentition and the change of teeth. Three of these skulls, now in my cabinet, have the front tooth worn, and the rear one coming into use; the whole line of teeth stretching on a surface of 19 inches, and forming an arc of 90°. The *front* tooth I cannot distinguish from that of the *M. Latidens* figured in the Geological Transactions; and the *rear* one, in the same animal, bears such perfect resemblance to the *M. Elephantoïdes*, that I cannot help risking the conjecture that the *M. Latidens* and the *M. Elephantoïdes* are one and the same animal; the specimens, from which the specific characters were taken, having been detached teeth.

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[*] Journal Asiatic Society, vol. iv. p. 58 ; date of communication, 3d January 1835.

[†] Geological Transactions, 2nd Series, vol. iii. p.377 *et. seq.* ; pl. 36 to 43.

Bringing this forward in the way of suggestion may be of use, in ultimately leading to truth. The question, however, must be determined by a strict examination of specimens; and having advanced the above supposition, I will take care that the means shall be provided.*

The minerals in this tract, west of the Jumna, correspond with those to the eastward, with the exception of the presence of the gold, which occurs in the beds of the rivers in these mountains, both eastward of the Ganges, and westward of the Jumna; but I am not aware of its existence in the intermediate tract. Under Nahun, gold-washers are constantly employed during the dry months; their daily return varying from two annas to two rupees, or from 3*d.* to 4*s.* The process is extremely rude. A piece of board, a long wooden trough, a ladle made out of a gourd, a sieve of the large grass which grows so abundantly in this part of the country, and a piece of hollow bamboo with a little quicksilver, constitute the portable apparatus of these most primitive washers for the precious metal.† A great deal of the gold-dust must necessarily be lost by this method of proceeding; and all the mercury, as it is evaporated in open air. The grains of gold are not larger than the small scales of mica, so common in river sand; and I have not heard that the metal has been found in large masses. This gold, too, has its localities, some streams being much richer than others. Where is the fountain head?

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* The rear or newly-formed teeth of every species of mastodon resemble those of the elephant, so far as relates to the integrity of the apices or summits of their transverse ridges; and they might therefore be mistaken for those of the *M. Elephantoïdes*; but the observations which led to the conclusion, that the Ava specimens of mastodon belonged to two distinct species, were not made on detached teeth. A repeated examination of the jaws and teeth described by Mr. Clift, and the knowledge that his opinion was formed from considering the size and number of the transverse ridges in relation to the length and breadth of the teeth, have tended to confirm my belief in the establishment of two species, which I must retain until further and more definite evidence to the contrary is adduced.—Referee.

† See further particulars of the gold-washings in the Gûmtí river, by Capt. Cautley, Journal Asiatic Society of Bengal, vol. iv. p. 279; Plate VII.; April, 1835.

In some stratum of this alluvium, perhaps, yet to be discovered, as the streams have no connexion with the higher mountains. A description of the washers, and the method practised by them eastward of the Ganges, have been given in the Journal of the Asiatic Society; and as there is little difference in the apparatus used at both places, it is not necessary to refer to it further.

Some of the fossils obtained by Mr. Colebrooke in the hills near Cooch Behar, and described by Mr. Pentland*, are identical with some of those obtained by the present discovery; and as the former were found in the most eastern extremity of this line, it is possible that a careful examination would prove the existence of animal remains throughout the whole of the intermediate mountains; all the tract being probably tertiary. An inquiry into the difference between the hills bounded by the Ganges and Jumna, and those westward of the latter; and into the confused and interminable dislocations, without any flats in the former, and the more scattered ridges with the intermediate plateaux of the latter, would only lead to a disquisition on the general formation of the dhoons or valleys lying between the Sevâlik hills and the great chain, which the limits of this communication will not admit, and must be left for future inquiry. It will be sufficient to state, that the general form of the mountains approaches more or less to a right angle, the long slope being covered with vegetation, and the crest terminating in a perpendicular and generally mural cliff, which descends into the beds of the torrents. The scenery from these cliffs is most picturesque, and many of the passes or ghàts up the torrents are bounded by gigantic walls of sandstone, varying both in height and character, and subject to all the tortuosities dependent on a river's course, forcing its channel through a complication of mountains. This effect is considerably heightened by the pointed and jagged style of the outline, depending on that abundance of clay and carbonate of lime throughout the whole formation, which permits even the shingle-beds to hold up their pointed summits in the wildest manner imaginable. At places, a perfectly inaccessible needle of shingle raises its head far above the others, and is crowned by one solitary fir tree, *Pinus longifolia*. This conical form, produced in the clays by weathering, is sometimes magnificently displayed, by the whole face of a cliff, consisting of light pink, yellow, and blue clays, being externally decorated with small conical spires of the clay from top to bottom, a height of 1000 feet from the bed of the river. The origin of this structure is due simply to a little coping stone, of some harder material than the matrix of the strata, and upon which the weather does not act so rapidly as upon the clay. Under a bright sun, the beauty of these cliffs, with their illumined pinnacles, is exquisite; particularly westward of the Jumna. I have before adverted to the presence of great abundance of lime, forming stalactites, and the cement of the sandstone and conglomerate. There is another striking method of deposition on the surface of the large stones which lie in the beds of the rivers, and which, during the greater part of the year, are in contact with the water. The substance is very similar in appearance to the coarse brown paper made in this country; and is produced by the water, while washing the stone, depositing its lime, and entangling the finer particles of vegetable matter, sand and mica, until the stone acquires a superficial coating, of a brownish yellow colour, which on removal resembles the substance before mentioned.

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* Geological Transactions, Second Series, vol. iii. p. 393; Plate XLV.

Note by the Editor Geol. Trans.

For detailed descriptions, by Capt. Cautley, Dr. Falconer, Lieut. Baker, and others, of the most important animals found in the Sevâlic Hills, see Asiatic Researches; Calcutta, 1836; vol. xix. Part. I.; and Journal of the Asiatic Society of Bengal, No 35. vol. iii. p. 527; Nos. 45, 46, and 48. vol. iv. pp. 495, 565, 706.; Nos. 49, 53, 55, 57, 58, 59, 60. vol. v. pp. 38, 291, 294, 486, 579, 661, 739, 768.

VII.—*Notice on the Remains of a Fossil Monkey from the Tertiary Strata of the Sewalik Hills in the North of Hindoostan.**—*By Capt.* P. T. Cautley, *F. G. S., Bengal Artillery; and* H. Falconer, Esq., *M. D., Bengal Medical Service.*

The most highly organized mammifers hitherto described in a fossil state, so far as our information extends, belonged to the *Cheiroptera;* and the instances of these on record are very few.† That quadrumanous remains should be wanting is by no means surprising, without the necessity of supposing that they did not exist. The countries of which the ancient races have been most completely investigated, had a climate unsuited to be the habitat of the tribe, as we now know it, when the more recent or superficial deposits were in progress of formation. If we refer to the remote epochs when the climate was suitable, and when genera now associated with the Monkeys were abundant, it is easy to conceive that the latter might have existed in numbers, without their remains being entombed. It requires in all instances many unconnected circumstances for the preservation of organic bodies, and their subsequent disclosure. Amongst the most important of these are the habits and organization of the animals themselves. As in the case of birds, it might be predicated, that this lucky concurrence of circumstances would be rare with quadrumanous remains. The very perfection in the organization of the Monkey entails, as a consequence, that his solid frame should seldom continue to indicate the previous existence of the individual. His admirable agility and social habits protect him against most aggressions. A flood might suffocate in their dens, over a large tract of country, the burrowing tribes; and might sweep from under the feet of the monkey hundreds of its herbivorous and predaceous fellow-tenants of the forest, and bury them in the near shingle or far-distant estuary, or drown and deposit them in the stagnant swamp—while he would remain secure. The tree on which he was perched might totter, and yield to the undermining current, and he still escape and feed on his wonted fruits, undisturbed by the destruction around. When the debt of nature comes to be paid, his carcase falls to the ground, and immediately becomes the prey of the numerous predaceous scavengers of torrid regions, the Hyæna, the Chacal, and the Wolf. So speedily does this occur, that in India, where Monkeys occupy, in large societies, mango groves around villages, unmolested and cherished by man, the traces of casualties among them are so rarely seen, that the simple Hindoo believes that they bury their dead by night.

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* From the *Transactions of the Geological Society of London*, Second Series, vol. 5.

† Brewster's Edinburgh Journal of Science.

When the ancient races of India began to open upon us in the new forms and the exuberant variety which the fossils of the Sewalik Hills exhibit, we were early led to anticipate that some trace of quadrumanous animals would soon be met with to perfect a series, which would be incomplete without them. Several months ago we became possessed of a solitary specimen, which put the matter, in our own minds, beyond all doubt. We deferred making it public, however, in the hope of soon finding specimens of the cranium and teeth; being unwilling to rest the announcement on any thing less characteristic. That chance has since fallen to our fellow-labourers in the pursuit, Messrs. Baker and Durand, of the Bengal Engineers, who have lately discovered a specimen, consisting of a considerable portion of the face, and the whole series of molars of one side, of a quadrumanous animal belonging to a much larger species than the bone we found.

Our fossil is the specimen which accompanies this communication. It is the astragalus of a right hind leg. It is completely mineralized, having a specific gravity of about 2·8, and it appears to be impregnated with hydrate of iron. Although but a solitary bone of the foot, the relations of structure are so fixed that the identity of the fossil is as certain as if the entire skeleton were before us. The very shallow excavation of the superior surface for the pulley-like articulation with the tibia; the form and extent of the lateral articulating surfaces for the external and internal malleoli; the considerable elongation of the apophysis for the head and neck of the bone; the slight obliquity with which it is sent off from the body; and the diagonal direction and form of the principal articulating surface with the calcaneum, are characters which, taken in conjunction, incontestably prove that the fossil is a quadrumanous astragalus. It would be needless, therefore, to dwell on the points of difference between it and the astragali of those orders of Mammalia which have an allied form. It is only requisite to ascertain how it agrees with the corresponding bone in existing species of Quadrumana. It closely resembles, in size and general form, the astragalus of the *Semnopithecus Entellus*, which we send along with the fossil for comparison.

The principal dimensions are as follow :—

Dimentions.	Sewalik Fossil Monkey.	*Semnopithecus Entellus.*
Extreme length of astragalus...........	1·3 inch.	1·35 inch.
Extreme width of body of astragalus....	1· ——	1·03 ——
Length of body.........	0·8 ——	0·85 ——
Greatest diameter of navicular head....	0·65 ——	0·65 ——
Thickness of ditto.......	0·45 ——	0·5 ——

The chief peculiarities of the fossil astragalus, compared with that of the Entellus, are these :—The upper articulating surface for the tibia is more convex than in the Entellus, and less square in the outline, the lateral margins approximating as they run backwards; the outer one being also more elevated. The peroneal articulation is precisely of the same form and extent as in the Entellus; and the rough fossa between it and the large calcanean surface also corresponds. The articular surface for the inner malleolus somewhat differs: in the fossil it is long, shallow, and rather pyriform in outline, while in the Entellus it is cup-shaped, deeper, and more extensive. The other pits and inequalities of the inner side correspond; but the entire surface slopes off more obliquely in the fossil. The great calcanean surface has the same diagonal direction, with reference to the upper surface, as in the Entellus: it has also the same form, but it is more vaulted, and has less stretch and width. Its inner margin is bounded by the shallow, pulley-shaped fossa for the tendon of the *flexor pollicis longus* muscle, entirely as in the Entellus; and the rough pit between it and the anterior calcanean surface is alike in both. The head-and-neck apophysis is sent off as in the Entellus. The upper surface of the neck is narrower and less sloped. The scaphoid surface of the head is altogether less extensive. The head itself is not so thick and massive, and its long direction slopes more obliquely upwards than in the Entellus; its inferior articular surface is less, and there is a wide, rectagonal, rough gutter or fossa running half way across, so as to make two surfaces. In the Entellus the fossa is obsolete, and only indicated by a minute foramen, so that these articular surfaces run into one. This is the greatest difference observable in the fossil. The rough fossa at the outer side of the neck is alike in both.

With these inconsiderable peculiarities, the fossil agrees so closely in size and general form with the astragalus of the Entellus, that it probably belonged to the same sub-genus: still the points of difference are sufficient to leave no doubt, that the fossil must be assigned to a distinct species. In equalling the Entellus, it would belong to the larger Quadrumana. This is all the information the specimen conveys, regarding the animal from which it came; but we may hope to meet with remains, which will develope its entire osteology, more especially that of the cranium and face. The fossil was found by a party of Hindoo collectors employed by us on the fossil tract of the Sewalik Hills; and was brought to us mixed up with a promiscuous collection of the remains of the Hippopotamus, Mastodon, Ruminants, &c., like the specimens which have been sent to the Society. We have not therefore the means of knowing the exact locality where, and the circumstances under which, it was found.

The discovery is interesting in itself as supplying a deficient link in the series of the former tenants of the globe; but greatly more so in connexion with the races with which the fossil was associated. We have excavated from, or found in the debris of, different beds of the same formation which yielded the fossil astragalus, the remains of a species of Anoplotherium,[*] the *Crocodilus biporcatus* and *C.* (*Leptorhynchus*)

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[*] *Anoplotherium Sivalense*, a new species, of a size somewhat larger than the *A. commune* of the Paris basin. The species is known to us by two upper jaws in our possession with the series of molars complete. We therefore quote it unhesitatingly.

Gangeticus,[*] respectively the Magar and Gavial, two species which at the present day inhabit the quiet waters of the Ganges. Here then are two most instructive facts: Quadrumana co-existed with a member of the oldest ascertained pachydermatous genus of Europe; and two reptiles now the contemporaries of man in the East, lived, and may have laved, in the same waters along with a species of one of the mammiferous genera which characterise the Eocene period of the West;—affording another illustration of constancy in the order of nature, of an identity of condition in the earth of the olden time with what it exhibits now, and of the invariableness of organized forms. The two decurrent ridges on the face which specifically distinguish the *C. biporcatus* of the present day, are as marked and distinct on the individuals which existed perhaps centuries of centuries ago; and an ankle bone of the Sewalik fossil Monkey so closely resembles that of a living species, that it is difficult to explain the difference.

The Sewalik fossils abound in monuments of this sort. There is a mixture of the new and of the old, of the past and of the present, of familiar with surprising forms, together with a numerical richness, such as no other explored region has exhibited within so comparatively limited a space. The Camel,[†] the Antelope, and Anoplotherium, have been found, intermixed with each other in the *same bed*. There are remains of the Elephant, Mastodon, Hippopotamus[‡], Anthracotherium, Rhinoceros[§], Hog, and Horse; the Tapir alone of the large existing Pachydermata being without a representative. In the Sivatherium[‖] is seen a huge Ruminant exceeding in size the largest Rhinoceros; it is also armed with four enormous sheathed horns, divided and foliated like the Dicranocerine Antelopes, and able to contend for mastery with the Mastodon. Contrasted with him in the same family is the puny

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[*] Known to us by specimens comprising the whole of the cranium and muzzle. They do not differ more from the existing individuals than these do from one another in varieties dependent on age and sex. Asiatic Researches, Vol. xix. Part II., Art. II.

[†] *Camelus Sivalensis* (Nob.), Asiatic Researches, Vol. xix. Part II., Art. X., a species of the size of the existing Camel.

[‡] Asiatic Res., Art. III. *Hippopotamus Sivalensis* (Nob. & *H. dissimilis*, Nob.).

[§] Journal of the Asiatic Society, Vol. iv. p. 706, and vol. v. p. 486.

[‖] Asiatic Research. *ut supra*, Art. I. *Sivatherium Giganteum* (Nob.). Since the memoir was printed, Col. Colvin, Bengal Engineers, has got a specimen of the cranium with the bases of the four horns attached, and we have in our possession an almost entire rear horn, which has given the characters noted above.

Musk Deer, scarcely larger than a Hare. There are the Cat[*] and the Dog tribe, the Hyæna, Bear[†], and Ratel[‡], and other Carnivora. In the feathered races, there are Grallæ, greatly surpassing in size the Gigantic Crane of Bengal (*Ciconia Argala*). Among the Reptilia, besides the Magar and Gavial, there were other Crocodiles[§] of enormous bulk, approaching the largest Saurians; and the Testudinata, which have hitherto held but a humble rank beside their Saurian co-ordinals, here show their giant representatives. In addition to numerous species of Emys and Trionyx not bigger than the small Terrapins of the sluggish brooks of Hindoostan, we possess humeri and femora of this tribe (with corresponding fragments of the bucklers) as large as the equivalent bones of the Indian Rhinoceros. As the Pterodactyle more than realized the most extravagant idea of the Winged Dragon, so does this huge Tortoise come up to the lofty conceptions of Hindoo mythology: and could we but recall the monsters to life, it were not difficult to imagine an Elephant supported on its back.

VIII.—*Memoir on the Geology of Cutch* [‖]—*By* C. W. GRANT, ESQ., *Capt. Bombay Engineers.*

GEOGRAPHICAL POSITION, AND PHYSICAL ASPECT.

The province of Cutch, in the East Indies, is situated between the 22° and 24° of north latitude, and 68° and 70° of east longitude. It is bounded to the north by the Grand Runn, beyond which is the Thur or Little Desert; to the S. W. and S. by the Gulf of Cutch and the Indian Ocean; to the E. and S.E. by the district of Guzerat; and to the N. W. by the eastern branch of the Indus and the territory of Sinde. Its extreme length from E. to W. is about 180 English miles, and its extreme breadth is 50 miles; but in one place it is not more than 15 miles across. It contains about 6500 square miles, independently of the

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[*] Asiatic Researches, Art. XI. *Felis cristata* (Nob.). Smaller than the Tiger.

[†] *Ibid.* Art. XII. *Ursus Sivalensis* (Nob.). Size of the *U. Spelæus.*

[‡] Messrs. Baker and Durand, Journal Asiatic Society, Vol. v. p. 581.

[§] *C. Leptorhynchus crassidens* (Nob.), an immense species far exceeding existing ones, and forming a passage from the Gavials into the true Crocodiles. It has the cylindrical muzzle and synostorized lower jaw of the former with the blunt thick teeth of the latter.

[‖] From the *Transactions of the Geological Society of London*, Second Series, Vol. v.

Grand Runn, which ought, however, to be considered as a part of the province, and which, including the islands with the portion bounded by the Guzerat coast, occupies an area of at least 9000 square miles.

Physical Aspect of the Country.—The province is hilly and rocky, with the exception of the part forming the southern coast, which is a dead flat covered with a fine rich soil. Three distinct ranges of hills, having an easterly and westerly direction, may be traced. The most northern forms an irregular chain bordering the Runn, and, for the greater part, presents to the north a perpendicular cliff surmounting a sloping talus, and to the south an inclined plane. It is composed chiefly of rocks, containing marine remains. The next, called the Charwar range, passes transversely through the centre of the province, and is connected with the former, at its north-western extremity, by a cluster of hills. It consists partly of sandstone containing beds of coal, and partly of a series of strata of slate clay, limestone slate, and slaty sandstone. The third, or southern range, and composed entirely of volcanic materials, has the same direction as the other two ; but it is of smaller extent, and a branch of it, striking nearly north and south, passes through the centre of the Charwar range. A number of isolated volcanic hills are also scattered over the plain and in other parts of the province, particularly on the borders of the Runn, where is situated the hill called Denodur, the largest in Cutch.

There are no constant streams, the river courses being merely channels for conveying the periodical floods to the sea, and containing, during the remainder of the year, only detached pools. The banks of these courses are, however, very high and precipitous, and afford excellent sections of the strata through which they pass.

FORMATIONS.

I have divided the country into the following eight distinct formations :—

1. Syenite and quartz rock.
2. Sandstone and clay, with beds of coal.
3. Red sandstone.—This formation I have been unable to trace the boundaries of. In mineralogical characters it resembles the new red sandstone of England, and differs materially from No. 2., or the formation which contains the coal.
4. Upper secondary formation, consisting of slate clay, limestone slate, and slaty sandstone, and containing *Ammonites*, with other fossils characteristic of the secondary formations of Europe.

5. Nummulitic limestone and marl.
6. Tertiary strata.
7. Alluvial, or recent deposits.
8. Volcanic and trappean rocks, including all such as bear evident marks of a perfectly igneous origin, as basalt, &c.

These eight divisions, considering the red sandstone as one, represent generally the geological structure of the province, though many minor subdivisions might doubtlessly be made.

1. SYENITE AND QUARTZ ROCK.

The only good example of syenite *en masse* is a hill called Calunja, near the town of Nuggur in Parkur, a district in the Thur, and not far from the mouth of the Loonee river. It is not in Cutch Proper; but as it forms part of the northern coast of the Runn, and is in other respects connected with the geology of the province, I have introduced it as one of the formations.

The Calunja hill is a confused heap of light red syenitic rocks, composed of quartz, red or white felspar, and large long crystals of hornblende; the compound being sometimes coarsely grained, and sometimes finely. The base of the main hill is surrounded with small conical mounds, which, at a distance, resemble the huts of a village. On entering the space occupied by these mounds, the hill presents a number of irregular, shattered masses, the sides of which are so steep, and are worn so smooth by the action of the elements, as to be extremely difficult of access. Between these masses the sand lies very deep. It is quite evident, that this hill has been violently acted upon by earthquakes.

In the bed of a river near the village of Koonerea, in the Puchum island, situated in the Grand Runn, I found some masses of precisely similar syenite, which were probably erratic blocks from the Calunja hill; this island lies nearly in the direction which would be taken by any sudden floods, coming down the Loonee river.

Quartz Rock.—This rock is principally developed in a hill of considerable height near the town of Mhurr, situated towards the western side of the province. The upper part of the hill is entirely composed of it, and huge masses are scattered about the base. A large cleft extends about half way up the western face of the hill, and displays its internal structure, consisting of a centre of quartz rock, surrounded by horizontal strata of loose, quartzose sandstone. The quartz rock varies considerably in character, being sometimes perfectly compact, exceedingly hard, conchoidal in its fracture, and smooth or foliated on the surface; in other parts it is saccharoidal; occasionally it consists of larger particles, so firmly cemented together that they break with smooth surfaces: some masses, again, have a decidedly granular texture; and one variety is composed of rounded pebbles of quartz of the size of marbles; but in no specimen did I find any other material than pure quartz.

From the extremely fractured appearance of this hill, and from the quantities of basalt lying about, and forming the principal part of some small hills immediately adjoining it, there can be no doubt that it has been subjected to igneous influence; and to the same cause the variety in the texture of the quartz is also probably due, some portions appearing to have been sufficently fused, for its particles to have agglutinated into a solid mass. This opinion may perhaps be further strengthened by an examination of the country near the town of Mhurr, distant about one mile and a half, where various dykes of basalt traverse the strata. Similar intermixtures of quartz with basalt occur in a hill called Peaka, from its piebald appearance, not far from Joorun, on the Runn, and nearly opposite the south-west extremity of the Bunnee: also in some low hillocks at the base of the Katrore hill in the Charwar range. At the village of Ghuranee, about ten miles east of Mhurr, a large dyke or vein of quartz protrudes from a level plain, and forms a ridge of solid rock about 30 feet in height. Basalt also crops out near the same spot.

2. Sandstone and Clay, with Beds of Coal.

This formation occupies a considerable portion of the country, and consists of a regularly stratified series of thick beds of sandstone, alternating with slate-clay, which contains, occasionally, bands of ironstone; and where the coal occurs, it is intermixed with blue clay or shale, and a greasy substance resembling fullers'-earth. South of the Charwar range, the general dip of the strata is S. by W. and S. W., at about one foot in twenty or thirty; but north of that range, the dip varies so much, that it is impossible to ascertain the prevailing direction; and the whole series is so broken, and intersected with dykes and dislocations, as to render fruitless all attempts to determine its general strike.

The centre of the province is dotted with hills containing igneous rocks; and the disturbed state of the beds, in their vicinity, may easily be conceived. The smaller hills are composed of confused heaps of a very ferruginous sandstone and ironstone, belonging to this formation, and the surface soil is a deep sand. The texture of the strata varies from a coarse, loose sandstone to a compact and extremely hard quartzose grit and conglomerate, cemented by ferruginous matter, some specimens being almost black.

Iron Ore.—In this formation, the iron ore smelted for commerce is procured. It is found in different parts of the country, but has been principally extracted near the town of Doodye, opposite the S. W. termination of the Bunnee. It there occurs in small lumps, which are of a spongiform texture, small specific gravity, and are very frangible. The natives, however, value this variety more than the heavier, from its yielding with greater ease to their imperfect means of smelting.

Manufacture of Iron.—In extracting the metal, layers of very small pieces are disposed alternately with others of charcoal, in a rude open furnace, and exposed to the blast of two small bellows made of sheepskins. The metal, when fused, falls into a hole at the bottom of the furnace, whence it is transferred to an inclosed furnace, and subjected to similar blasts, until brought to a white heat, when it is taken out and beaten into a bar. No flux of any kind is used. A considerable quantity of iron was, at one time, made from a totally different description of ore, found near the village of Punundrow, in a plain which extends to the sea or eastern mouth of the Indus. This plain is bounded to the south by low hills covered with fragments of basalt, being outliers of a basaltic range further to the south-east. The surface of the plain is composed of a fine smooth gravel, composed of comminuted particles of iron ore, and has every appearance of having been, at no distant period, covered with water. The iron ore is found near the surface of the low hills above mentioned, in small tabular fragments imbedded in a purple-coloured earth ; and those pieces are selected, which give a bright streak on being struck by a pointed instrument. Externally the ore is of a purple colour, and internally presents small dark blue fibres, arranged at right angles to the surface of the specimen. In another place a variety occurs, which resembles small fragments of tile, but has the same internal structure. It is very hard, and of considerable specific gravity ; and is said by the natives to have yielded a much greater per centage and much better iron than the ore found at Doodye ; but the manufacture of it has been suspended, owing partly to the scarcity of fuel, and partly to English iron being procured at a cheaper rate, as well as in much more convenient forms.

Coal.—Coal has been found in this formation in various places, but not in beds sufficiently thick to be worth working. It was first discovered in the bank of a river near the city of Bhooj, forming a bed about 18 inches thick, and associated with strata of sandstone and blue clay, the dip being, to the eastward, one foot in twenty. This bed was worked for some time, and considerable quantities of its produce were sent to Bombay, but the quality was bad, being very slaty, and containing a large proportion of incombustible matter. Attempts were afterwards made to discover coal in other parts of the province; and although various beds were met with, they were too thin to be of any value. This search was carried on principally to the south of the Charwar range, a few miles from the town and fort of Seesaghud. One bed was found of a very good quality, but only 9 inches thick. It consisted of masses composed of small cubical pieces, which soiled the fingers very much, had not the slightest appearance of a lignite, and ignited quickly, burning with a bright flame, and leaving a small residuum, but it would not cake. It was found on trial to get up the steam of an engine-boiler very well and quickly, but a much larger quantity was required than of English coal, owing, partly, to its breaking into so small fragments as to fall through the bars of the grate.

Borings for Coal.—A boring for coal was made near this bed; and although 270 feet of sandstone and blue clay were penetrated, no coal was found. A similar attempt was made six miles further to the eastward, and to the depth of 191 feet, but with no better success; and similar researches were made in one or two other places. The second trial passed through a regularly alternating series of sandstone and blue clay. Some of the sandstones were so extremely hard (being composed of quartzose particles cemented by ferruginous matter) as to be almost impenetrable. A jumper, worked by a lever-bar, making eighteen strokes in a minute, penetrated, after eight hours' work only, from 1½ to 2 inches. Other specimens of sandstone varied both in hardness and quality; and at a depth of 190 feet, a bed of white, pure quartzose sand was entered, when water immediately rushed to the surface, and continued to flow in such quantities as to stop the work. The shale was of a very dark blue when first brought up, but it lost the greater part of its colour after exposure to the sun. Iron ore and iron pyrites were found. All the banks of the rivers in the neighbourhood present strata of sandstone and slate-clay, with bands of ironstone, and, in places, thin beds of coal. The general dip is, to the south-west, about one foot in twenty; but the strata are greatly shattered and dislocated by dykes, slips, and hitches.

Vegetable Impressions.—The slate-clay, and, in some cases, the sandstone, contained numerous impressions of ferns and reeds, occasionally of a large size. One specimen, which was flattened, was four inches in breadth, and the outer surface was carbonised, but the interior was filled with sand: this was generally the case, though other specimens were carbonised throughout, and some were mere impressions. In digging wells within the limits in which they occur, coal was frequently found, but always in thin beds; and some of it ought more properly to be called lignite.

Extent of Coal-field.—The coal-field, if it may so be termed, is bounded to the north by the upper secondary or laminated slate-clay and limestone slate formation; and to the south it is cut off abruptly by a low range of volcanic and trap hills. I could not ascertain whether it had ever been covered by any conformable, stratified deposits. Thin beds of coal have been found in various other parts of the formation. The general structure of this series of strata, the quality of some of the coal, the nature of the sandstone and slate-clay, the impressions and remains of reeds, ferns, &c., the bands of ironstone, the dislocations by dykes, slips, &c., all bear an analogy to the coal-fields of England; but I am inclined, from the vegetable remains, to consider this deposit an equivalent of the oolitic coal of England, and not of the regular carboniferous system.

ALUM WORKS NEAR MHURR.

The ground on which Mhurr is built, consists of high, irregular banks of marl of every variety of colour, but in a most confused and shattered state. It is surrounded on three sides by steep hills, forming a kind of amphitheatre; and nothing can be more desolate than its appearance. North of the town is a high table-land, which extends to some hills about one mile and a half distant. It is composed, near their base, of a ferruginous quartzose sandstone, on which the variegated marls rest; the latter being covered, in many places, with a bed of coarse gravelly detritus, six or eight feet thick. Imbedded in this gravel, are some very large masses of basalt, and of a very hard, black stone, composed of grains of quartz cemented by an almost black oxide. They are cut into mill-stones for grinding flour. The whole are evidently boulders from the hills to the northward, which were mentioned in the first part of this memoir, as consisting of quartz and basalt. This plain terminates, to the southward, in a high bank overlooking the town, and intersected in one part by a large dyke of spheroidal basalt, which has apparently so indurated the strata of variegated marl in its vicinity, as to permit them to be quarried for building. A large quantity of alum is made at this place, and exported to different parts of India.

Manufacture.—The shale from which alum is obtained, forms beds in the variegated marl; and in a kind of blue clay. Long galleries are cut for the purpose of extracting it; but so plentiful is the supply, that no means are taken to support them, and they generally fall in during the rainy season. The manner in which the alum is prepared is very simple. The earth is exposed in heaps to the sun and air for about five months, during which it burns spontaneously. It is next laid out in little beds similar to those of a field prepared for irrigation, and it is watered by a small stream for ten or fifteen days, by which time the aluminous matter accumulates into semi-crystalline plates. This substance is boiled in water for about seven hours; after which, a third, or one half, by weight, of potash is added, and it is again boiled for a few hours, according to the strength of the ley. It is then poured into large open vessels, where, after settling for some time, it is washed, and the liquid drawn off, leaving an impure crystalline sediment. This is once more boiled, and when it arrives at a proper state, which is learned by practice, it is poured into large earthen vessels with a small mouth, and sunk into the ground to prevent their breaking. After a time, the vessels are dug out, broken to pieces, and a lump of pure alum extracted. Six or eight measures, by weight, of alum, are produced from ten measures of the substance from the irrigating beds, and four or five measures of potash. It is not so much esteemed in the Bombay market as that brought from China, on account of its yellow tinge.

Some of the marls resemble chalk, being white, and soiling the fingers; and some are very calcareous, whilst other varieties scarcely effervesce with diluted muriatic acid. In one mass I found a very minute specimen of *Buccinum pumilum.* These marls also occur of every variety of colour as well as texture; some of them consisting of innumerable thin laminæ curiously twisted and arranged in the most intricate manner; and others of a kind of breccia, composed of small broken portions of marls. Several dykes of basalt cut through these beds; the whole presenting a most confused assemblage, partly due to natural causes, and partly to the numerous mines which have fallen in. One of the banks has been burning spontaneously for several years, in a similar manner to that at Kuttrea, and apparently from the same cause. The exact geological position of these marls I could not determine.

3. RED SANDSTONE.

I have mentioned a red sandstone formation, which may be described now. It occurs to the southward of the coal series, and is separated from it by a low range of hills about six miles broad, composed partly of basaltic rocks, and partly of a variety of porphyry. This sandstone is regularly stratified, and has the same dip and inclination as the sandstone and coal series, but differs very materially from it, in being much softer, generally finer-grained, of a vast variety of colours, and by containing no organic remains. Associated with the sandstone are beds of clay, varying in colour from purple to deep red. One of the beds is aluminous, and has been burning spontaneously for a long period. The smoke issues from a deep crevice in the bank, and the fumes are highly sulphureous. A stick thrust into the crevice soon ignites, and the whole bank has a burnt appearance; the red clay, which rests immediately upon the stratum, having been converted into a perfect brick, and the other variegated clays having been variously acted on. Although this bed would yield a large per centage of sulphate of alumina, it has never been worked. The strata dip at an acute angle to the south, and are covered, in that direction, by beds of gravel, succeeded by others of sand and soil, which extend to the sea.

4. LAMINATED SERIES OR UPPER SECONDARY FORMATION.

Alternating strata of slate-clay, limestone-slate, and occasionally slaty sandstone, constitute this formation. The more calcareous beds are very hard and compact, whilst some of the others are very earthy and friable. In many of the calcareous slabs, the upper and under surfaces are argillaceous, hard, and compact, but the centre is a grey limestone, which takes a good polish, and might be used for lithography. The slate-clay is of a dark blue colour, and generally peels in thin flakes, leaving a flat, lenticular nodule or centre. In many places, vast thickness of this laminated slate-clay occur without the least admixture of the sandstone-slate, whilst in others, the latter alternates very often with it.

The beds being horizontal, except where they have been disturbed, the formation occupies considerable tracts; and where it rises into hills it is generally capped by a thick bed either of coarse, soft sandstone, as in the ghâts of the Charwar range, the Bhooda hill (near Bhooj), the Jarra (near the Indus), and other hills; or of a very compact, hard, crystalline sandstone, with a conchoidal fracture, as in the Chuppal hills, the Jarra, and in other places, including the natural walls of the Runn, described in a subsequent part.

Relative Position with respect to the other Strata.—I searched diligently to find the relative position of this formation distinctly defined, but in vain, as, at its apparent junction with other beds, the whole of the strata were broken up, and so confused as to baffle every attempt to ascertain the boundary. I am induced, however, to believe that it occupies hollows in the sandstone and coal formation, or abuts against it. It cannot underlie that series, because its strata are always *horizontal*, except where locally disturbed; while the beds of sandstone and coal are as invariably inclined at a considerable angle, and are everywhere intersected with dykes, slips, and other dislocations, from which the upper secondary strata are generally free. In one instance the formation evidently occupied a hollow in the coal sandstone.

In many places it appears to abut against the sandstone, occupying large tracts which may, at some period, have been covered by beds of that formation, subsequently washed away. From what has been stated above, it is at all events newer than the coal beds; and this conclusion is also borne out by its imbedded fossils.

Apparent Position with respect to the English Series.—In its mineralogical character and general appearance, this formation greatly resembles the English lias; but its fossils have been found, after a careful examination by Mr. James Sowerby, to assimilate very closely to those of the oolitic beds; and a very few belonging to the green sand.

Fossils.—Of the fossils found in these beds, the Ammonites are the most characteristic, occurring in vast quantities, particularly in some hills bordering the Runn. Of the eleven species which I collected, eight are unknown to Mr. James Sowerby, to whom I am entirely indebted for all my information regarding them. Of the other three species, one so closely agrees with *A. Herveyii* of the English cornbrash, that he is induced to consider it only a variety of that species; another in the outer whorl resembles *A. perarmatus* of the coral rag, but differs in the structure of the inner whorls; and the third, of which there is only one imperfect specimen, is like *A corrugatus* of the inferior oolite of England. They generally vary in diameter, from three to five inches: the largest I found being eight inches. It was imbedded in a mass of gold-coloured oolite. The genus next abundant is the Terebratula. Of the seven species collected by me, five bear so close an analogy to the *T. biplicata*, *T. dimidiata*, *T. sella*, *T. intermedia*, and *T. concinna* of the green sand and oolitic series, that it has been found impossible to consider them distinct species. The Trigonias are numerous, though confined to two species, one of which differs so very little from *T. costata* of the lower oolites of England, that Mr. Sowerby considers it only a variety of that fossil. The genus *Pholadomya* also abounds, but the specimens are generally broken. Of the three species I collected, Mr. Sowerby has not been able to establish an identity with any known Pholadomya in England, although there is a general resemblance to the oolitic and lias fossils. I found two species of Belemnites, one of which resembles *B. canaliculatus* of the inferior oolite; the other is not determinable. Of the species of oysters, one resembles the *Ostrea Marshii* of the English cornbrash. I found it in a bank high up the Katrore hill, in the Charwar range, in friable, laminated strata of slate-clay and sandstone slate, associated with Ammonites of the same description as those at Charee and along the Runn*. I did not find a single specimen of a Gry phæa, although numbers of the genus have been collected from this province. Some crinoidal stems, which I collected from the same localities resemble those of a species found in the mountain limestone; but as the fossils above enumerated characterize the middle series of the English upper secondary rocks, fossils belonging to so much older a formation can hardly be associated with them. These crinoidal remains, therefore, probably belong to an undescribed species. The only fossil bone which I discovered, Messrs. Clift and Owen consider to be a caudal vertebra of a Saurian. This determination is, however, very interesting, as it shows how widely these animals were distributed; being, in this distant country, also associated with the same mollusca (one valve of a *Trigonia costata* is imbedded in the mass containing the bone) as accompany their remains in the English strata.

In the Appendix to this paper I have given a complete and systematic list of all these fossils, stating the localities where I collected them.

General Shape of the Hills belonging to this Formation.—Many of the hills in Cutch present, on the north side, a perpendicular cliff surmounting a sloping talus, and on the south an inclined plane; and they owe this peculiar outline to their being composed of a base of laminated clay or sandstone, capped by a thick bed of coarse and brittle sandstone. This is particularly the case in the Jarra hill, and the hills of Hubbye, Lodye, and Roha-ké-Koss, near the village of Joorun, on the Runn; also those of the Puchum and Khureer islands in the Runn, particularly the latter; likewise those near Beyla, at the north-eastern extremity of the province, and many others The Katrore hill, forming the eastern extremity of the Charwar range, belongs to this formation, and, therefore, differs materially from the greater part of the range, which is composed principally of sandstone, except in the portion opposite Bhooj, where this laminated series also occurs. The strata being principally horizontal, the hills have a conical form.

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* At the base of these hills, and forming the immediate borders of the Runn, fossil shells are found of a very different description, among which I may enumerate *Cardium*, *Pecten*, *Corbula*, *Venus*, *Globulus*, and vast quantities of *Turritella*; which last form large masses of rock protruding every here and there above the bed of the Runn.

It is a curious circumstance, that, in the same group, some of the hills of the laminated strata have a thick capping of sandstone, whilst an immediately adjoining peak, of equal height, has none. I conceive the thick beds of the sandstone once covered the whole surface, and that on their upheavement they broke into masses, which have been since denuded from some of the hills, the debris forming the deep sandy plain around Bhooj.

In the hill of Jogé-ki-bit, near Nurra, on the Runn, the beds dip from 40° to 50° to the north, and alternate three times with basalt. The strata vary greatly in character, some of them being very hard and crystalline, particularly those containing calcareous matter; whilst other parts of the series, immediately adjoining, are very friable and earthy. Some of the schists assume the character of a roofing-slate, and others are only soft, laminated blue clay.

A cluster of hills, occupying a surface of three or four square miles to the north-west of the city of Bhooj, called the Bhoodha hills, also belongs to this formation, being composed of slate-clay, tabular sandstone, and limestone slate, in many parts assuming a very friable, earthy texture, and frequently capped with thick beds of coarse, soft sandstone. The strata are often horizontal; in which case the hills are conical; but in many instances the beds incline at a considerable angle; and the hills assume, when capped by the sandstone, the usual form of an abrupt escarpment, with a long inclined opposite side. They are intersected by numerous ravines and nullahs; the looseness of the soil, and peculiar tabular construction of the strata, offering a very slight resistance to the action of the rains. The Chuppal hills, between Guranee and Nurra, in the north-western division of the province, afford another example of the elevation of these strata into hills. They consist of beds of a very earthy and friable description, covered by a thick stratum of hard crystalline sandstone, slightly calcareous; and the lower part forming a sloping talus, capped by the hard rock, in masses 20 feet thick; they appear as if they were surmounted by old ruins or turrets.

Manner in which the Hills have been formed.—From an attentive examination of these hills, I am led to infer, that they have all been uplifted by a movement which proceeded from below; the laminated series having yeilded to the upheaving power, and the loose brittle sandstone having broken off abruptly. That this has been the case with the minor ridges, and what I may term the *natural walls* in the Runn, described in treating upon that district, there can be no doubt, as I have found them at angles, varying from a few degrees above the horizontal position to the vertical, and even turned over beyond that point.

That these beds have been disturbed and broken through by igneous agents is quite evident from the dykes of basalt, which occasionally intersect them.

5. NUMMULITIC LIMESTONE AND MARL.

Although the imbedded fossils of the Nummulitic group resemble those of some tertiary beds of England and France, still the strata of which it consists, differ so totally in mineralogical character and general appearance from any of the other formations in Cutch, that it deserves a separate notice. It is bounded partly by the second or sandstone and coal formation, partly by beds which I have named tertiary, and partly by the alluvial banks of the eastern branch of the Indus, extending from Luckput to a plain between the villages of Wagé-ké-Pudda and Eyeraio, about thirty miles to the southward. It consists of a mass of small Nummulites mixed with Fasciolites; and some of the river banks present a perpendicular section of solid rock, from 60 to 70 feet in height, entirely composed of these small fossils agglutinated together, and varied only by a species of Orbitolites, frequently bent into a saddle shape. This stone has much the appearance of chalk, and the beds are horizontal, except where they have been disturbed. In some parts, however, it is much harder, particularly near the town of Luckput, where it is quarried as a building stone, and is also burnt for lime. The surface-soil is entirely composed of the small fossils lying loose, and generally known by the name of Luckput sixpences.

The beds of nummulitic limestone on which Luckput stands have been affected in a manner deserving of notice.

The high ground to the east of the town sends off three parallel ridges to the westward, ranging nearly east and west. On the two northernmost of these ridges, the north and south walls of the fort of Luckput are built; whilst the southernmost lies at a distance of about 200 yards from the south wall. A kind of valley runs through the town, ending, at its western side, in a swamp, which is crossed by the western wall of the fort. A cut through the northern ridge exposes a very good section of the nummulitic stone, dipping 40° to the north; whilst, in a similar cut through the southern ridge, made for the purpose of connecting two tanks, the same beds dip from 40° to 50° due south. In the centre ridge the section is not quite so perfect, but the beds are nearly, if not truly, horizontal, forming an anticlinal axis to the other two.

This elevated tract of the nummulitic limestone extends only three miles to the eastward of Luckput, the ground there descending abruptly into a plain, composed of various clays, a coarse ferruginous stone and sandstone, with quantities of selenite scattered about, the whole presenting a confused appearance, as if it had been the site of an igneous outburst. Patches of ground, every here and there, have also an altered appearance, and are covered with small fragments of igneous rock. The plain is bounded to the south by a low range of basaltic hills. From Luckput southward to the village of Punundrow, the same nummulitic rock continues, but varies in hardness from a compact limestone to a white marl. It is also very well exposed between the villages of Eyeraio and Wagè-ké-Pudda, at the southern limits of the formation. To the S. W. of Eyeraio is a plain, composed of a white calcareous marl, and flanked to the south by a low range of hills of the same material, sending off into the plain numerous small projections, with rounded terminations precisely like headlands. Numerous isolated hillocks, or high banks, with sides worn in the same way, and resembling islands, are scattered about the plain, and the whole surface looks as if it had only lately been deserted by water, or as if a violent flood had swept over it. The banks of the small nullahs, which intersect the plain, are composed of gravel, containing rounded masses of a variety of the calcareous marl. Advancing westward, the ground rises a little, and the surface consists of a hard rock, which contains oysters and other bivalves, whilst in some places large patches are entirely composed of silicified corals. I also found in this place fragments of fossil bone, said by Messrs. Clift and Owen to be parts of rib-bones, like those of the *Manatus*, but flatter. To the north, this plain is bounded by a river, the perpendicular banks of which, 60 or 70 feet in height, consist entirely of nummulitic marl, capped by a thin stratum of gravel. In one part, the bed of the river is subjected to the action of a small stream of water, so strongly impregnated with saline ingredients, that large lumps of salt are formed in the hollows worn in the rock, which here assumes the character of a hard limestone, probably in part due to the quality of the water that passes over it. The beds are horizontal, except where they have been disturbed and shattered.

Characteristic Fossils.—The most characteristic fossils of this formation, next to the Nummulites and Fasciolites, are Echini, Galerites, Clypeasters, and Spatangi. The species of Echini and Galerites are all new. A Clypeaster resembles *C. affinis* of the sandy marl of Brabant; and a Spatangus, the *S. Bucklandii* of the marly chalk of Westphalia; while another species agrees with the *Spatangus acuminatus* of the tertiary deposits of Dusseldorf. The other fossils consist of species of Tellina, Astarte, Cardium, Arca, Pectunculus, Pecten, Nucula, Ostrea, Cerithium, Turbinellus, Globulus, and Seraphe. The Turbinella abounds and is often very large. In the bed of the river above described, I found large blocks composed entirely of small oysters, similar to *Ostrea Flabellulum*, but more regularly and finely striated.

6. TERTIARY STRATA.

I have called all that portion of the province *tertiary* which is composed of rocks containing fossils belonging to this period. It consists principally of a hard argillaceous grit, interspersed with fossil shells, and covered by beds of pebbles or conglomerate. Some portions of this conglomerate are very coarse, and constituted of rolled or boulder stones loosely connected; whilst other portions are sufficiently indurated to be used as a building stone. A calcareous grit, which soils the fingers like chalk, also occurs in patches, and contains innumerable small shells. It is used for building, and is burnt for lime. The beds are horizontal, and the surface of the country is generally covered with a fine rich soil.

At the village of Soomrow, about ten miles north-east of the fort and harbour of Juckow, on the south-western coast, the banks of a broad river-bed are composed partly of a loose gravelly soil, and partly of a very hard, compact, calcareous rock, full of shells, and burnt for lime; and below this rock is a coralline limestone. The river-bed, in some places, is nearly a mile across, the banks being cut into ledges or steps, whilst numerous small hillocks, or high banks of gravel and clay, stand isolated in its middle. Only a small stream now winds from shore to shore. One part of the northern bank rises into a small hill, the surface of which is composed of the same hard, compact, shelly rock as that which is found even with the bed of the river. For some distance north of this spot, the ground is also high, and cut into innumerable ravines; and there are breaks in the surface, as well as circular hollows, or large, deep pits. The natives have a tradition, that an earthquake occurred at this spot, some centuries since, during a severe battle between the Sindians and the natives of Cutch. The raised position of the shelly rock, and the peculiarly rent and broken appearance of the ground, indicate some convulsive movement; and it should be noticed, that, as all the beds are horizontal, those forming the hill cannot be an unbroken continuation of those in the banks of the river.

This formation continues a few miles further to the northward, where it abuts against the nummulitic beds.

In many places towards its northern limits, it rises into hills, and considerable tracts of high, undulating country; the loftier portions consisting invariably of hard, shelly rock, including large patches, of one or two acres in extent, of silicified corals; and the lower parts, or intervening spaces, of a loose gravel or clay, equally full of organic remains. Some parts of this district, particularly that near the village of Kotra, have a very remarkable appearance, as if they had been subjected to a violent flood, which had washed away the surface-soil to a depth of 30 or 40 feet, leaving a broad, shallow valley, two or three miles across, with numerous isolated and rounded bluff hills of gravel, scattered about its bed. The banks, or bounding lines, consist of low hills, cut into innumerable small ravines; the whole being composed of the same shelly rock, and gravel, and clay as above described.

The fossil shells found in this district occur often in beds, consisting of a single species. One of the hillocks, above described, is about 60 yards long by 20 broad, and 15 feet in height, and is entirely covered with *Ostrea callifera*, lying loosely on a gravelly soil, or cemented into a solid rock. The highest part of the table-land in one place, near the village of Kotra, is also composed solely of oysters, forming a very hard rock or limestone; other isolated banks are completely covered with what appears to be a species of large Serpula, or else fragments of coral. Numerous other fossils are found, either lying loose or imbedded in the rock, and consist of species of Lucina, Venus, Cardium, Pecten, Ostrea, Turritella, and Clypeaster. The Turritellæ are imperfect, but particularly numerous.

This flat valley or broad river-bed (for a small stream still winds through it,) continues to the hills surrounding the town of Mhurr, spreading, in places, into lake-basins, all of the same description as above detailed; but, a short distance south of the Mhurr hills, its course is cut across by a dyke of very compact basalt, of perfectly columnar structure; each face of the polygons being about two feet in breadth. This basalt forms both banks of the river for 50 or 60 yards, and to the height of 20 or 25 feet; the bed of the river being also formed of sections of the columns. The clay through which the basalt passes is hard, and of a brick red; and quantities of iron ore, of a spongiform texture, are scattered about.

The southern base of the Mhurr hills is now approached, and presents a most confused appearance, the country at their foot being shattered in all directions. It is impossible to conceive ground in a more disturbed state. The banks and ridges, varying from 20 to 60 feet in height, are partly composed of a coarse, calcareous grit, full of the marine shells already enumerated, and partly of a blood-red coloured clay, which has apparently been altered by a trap dyke. One bank exposes a section, 60 to 70 feet high, of horizontal layers of gravel, clay, shelly rock, and iron clay, which in one spot appear to have fallen in bodily, dipping abruptly from both sides to a point.

Fossils.—The principal deposit of fossil shells which came under my inspection, was at the village of Soomrow, just described. The specimens which I collected have been examined by Mr. James Sowerby, and found to consist of 33 known genera. Of the 57 species belonging to these genera, 47 are new, 6 are known, and 4 are doubtful. The most numerous among the univalves belong to the genera Mitra and Voluta: there are also great quantities of the genera Cerithium and Terebra; some of the latter being very beautifully marked. The genera Solarium, Conus, and Strombus also abound. Among the bivalves, the Pectens are most numerous; and among the Radiata, are great numbers of Clypeaster. Most of the fossils which I collected, either lay closely on the gravelly bank, or were cemented into large tabular slabs of rock.

I was informed by the natives, that, about the year 1834, great quantities of large fossil shells, called by the country people *Sonk* or *Conk*, being a species of Turbinella, were found in a land-crack, in a field about two miles from this spot; and so perfect, that they were given to the priests of the different temples in the neighbourhood, who, by inserting a metal tube into the apex of the shell, converted them into horns, to call the devout to prayer. I could not, however, find any when I visited the spot, the crack having been filled up by subsequent floods.

Extent of the Tertiary Formation.—These tertiary beds reach, in one place, to the town of Mhurr, a distance of thirty miles from the sea, and extend in a belt of, perhaps, a third of that breadth, throughout the whole southern coast of the province. A narrow line should also be drawn along the borders of the Runn, and around the islands in it, as the fossils, found on the immediate shores, belong to the tertiary period.

7. ALLUVIAL, OR RECENT DEPOSITS.

These consist entirely of plains covered with soil, evidently detritus which has been washed from the hills, or of land recovered from the sea by the blowing up of sand. The whole of the province south of the volcanic range might be considered alluvial; the surface being composed of a thick soil, formed by the rapid decomposition of the basaltic or igneous hills; but as the banks of the rivers contain tertiary shells, I have thought it better to designate the district as consisting of rocks of that age. The boundary between the tertiary and alluvial districts must, therefore, be considered partly imaginary, as I have thought it more correct to give a general outline, than to mark, with apparent minuteness, limits, which my examination of the district, did not enable me to ascertain.

Land gaining on the Sea.—In many places along the coast, where there are ridges of sand, the land gains upon the sea. These dunes are constantly increasing, from the particles blown up by the sea-breezes, or the south-west winds, which prevail during so great a portion of the year; and the ridges frequently occur in double rows, occupying a considerable breadth, and varying from 50 to 100 feet in height. During strong winds the whole appear to be in motion, from the sand drifting along their surfaces.

At Mandavee, the principal seaport in Cutch, is a ruin on a spot called the Old Bunder, or Quay. It is now about three miles inland, and is situated on the bank of the river, which flows into the sea near the present town; but at the time when this old quay was in use, the town must have been some distance from the present shore. A small temple, built upon a rock, now in the middle of the town, is said to have been at that time also in the sea. Even now, a considerable space, composed of loose sand and sand-hills, intervenes between the town and the sea; and the distance is continually increasing, owing to the quantity of sandy detritus brought down by the river during the periodical floods, and washed back by the sea in the dry season. A bar is also thus formed across the mouth of the river, and the position of it varies so much, and so often, as to render the entrance to the river very difficult. Even boatmen belonging to the port, who have been absent a few months, cannot pilot their vessels in. During very dry seasons, this bar increases to so great a degree as almost to block up the entrance entirely; and the laden boats always strand upon it at high water, their cargoes being carried away by carts, when the tide is out.

At Moondrah, Budraseer, and other seaports up the Gulf of Cutch, the land also gains upon the sea, rendering necessary the frequent removal further seaward, of the quays or landing-places. Where rivers enter the gulf, this increase of land at their mouths is easily understood, as the sea, for nine months of the year, washes back the sandy detritus accumulated by the river at its delta during the periodical floods. Where rivers flow all the year round, they may be enabled to keep a channel through the deltas constantly free; but when the stream is inert during three fourths of the year, and the wind and sea are continually at work, the case must be very different.

Marine Forests.—The same operation is in progress at places separated from the main waters of the gulf by small creeks.

Some of these inlets penetrate six or seven miles from the coast through a tract covered for miles in extent with shurbs. At low water, these plants are exposed to their roots; but at high tides merely their upper branches are visible, so that the boats sail through a marine forest, the sails and yards frequently brushing against the boughs of the trees. The growth of these shrubs is so rapid, that the sailors have very often to force their boats through the upper branches, particularly at the various angles of the very tortuous creeks, when they wish to save a tack, and the wind is scant. The stems and branches of the trees are covered with Crustacea and Mollusca, whilst numerous water-fowl occupy the higher branches; the whole presenting a most curious picture. That the land should gain on the sea, in these places also, is very natural, as during the monsoons, when the numerous small streams convey their muddy alluvium into the gulf, the roots and stems of the shrubs act as a filter, and the water passing slowly between them, a great portion of the earthy matter is precipitated; a portion also adhering to the stems.

Effects of Floods.—Considerable damage is frequently done by the periodical floods, which, from the peculiar hilly structure of the country, sometimes rush down with a force, that carries all things before them.

In August 1834, the rains were very violent and long-continued, and did considerable damage. The river, which flows past Nurra, and through the flat, from six to eight miles bread, which extends from the town to the Runn, brought down so much alluvium, as to cover with a fine soil a surface of 150 pragas, or nearly 1000 acres of land. This tract had been sunk by the earthquake of 1819 so nearly to a level with the Runn, as to have remained unfit for cultivation. On the opposite side of the province, at a village called Kundagra, not far from Mandavee, 50 pragas or 300 acres of soil were entirely washed away, leaving a bare sandy surface, similar to the bed of a river; and not far from the same spot, half a small village, with a quantity of land, was swept bodily into the sea; large trees being uprooted and carried down by the flood. At Pheraudee, 12 miles N. E. from Mandavee, at Mandavee, and many other places, great devastations are said to have been produced. A few similar inundations would alter the features of the country, consisting of such abrupt hills and loose surface-soil.

8. Volcanic and Trappean Rocks.

The district composed of volcanic and trappean rocks is one of the principal features in the geology of Cutch, not only from the space it occupies, but from the phænomena which it presents.

The igneous origin of trap being acknowledged, I shall always speak of it and lava under the comprehensive term of igneous rocks, as in composition they differ only in the proportions of hornblende, felspar, and augite, and as they all appear to have originated in the same cause, and to have equally disturbed or affected the neighbouring strata. But there appears to be a very marked distinction between those rocks which have been in fusion below the surface, and subsequently forced up, and those sedimentary formations, which have an altered appearance, and have been evidently subjected to violent heat since they were deposited in their present position. The latter rocks, however, bear a very small proportion to the former.

Evidence of the disturbing power of Igneous Agents.—It is impossible to desire clearer evidence of the disturbing power of igneous agents than is developed in Cutch. The shattered appearance of the country in some places, the upraised hills in others, with the igneous rock or moving agent, either directly under them, or immediately in front of the outcrop of their strata; the angles to which the beds have been raised varying from a gentle, unfractured slope to the most complete dislocations; the vast variety in the composition of the igneous matter, from the most loose and clay-like form to the most compact and perfect columnar basalt; the crater-like shape and construction of some of the hills, from which large lava or basaltic streams can be traced, prove the igneous origin of these rocks, and the vast effects which they have produced on the general appearance of the country. Moreover, it is not necessary that the igneous matter should be on every occasion apparent; as, where we find a large mass of basalt which has evidently come from below, lying on a plain, behind a hill presenting a bluff cliff towards the igneous rocks, and the strata sloping sharply from them, the conclusion is obvious, that the hill must have been raised by the outburst of the volcanic matter; and it is equally just to infer, that, in its passage from below, it must have disturbed, more or less, the various beds through which it passed; and, therefore, that the form of many hills may be owing to a latent exercise of this power, even where no traces of the igneous matter are visible near the surface, or near the raised strata. That the greater number of these igneous rocks have been forced up, and are not portions of lava streams which have flowed from volcanos, is very evident, from the manner in which the superimposed strata are affected by them.

In a preceding part of the paper I have described a hill of quartz rock near Mhurr, and shown that its strata have been violently disturbed; and I have also inferred, from the nature of the rock, that its characters are due to grains of sand having been agglutinated by volcanic heat. In detailing the phænomena presented by the second formation, I have shown that its strata have been also subject to great dislocations.

In describing the upper secondary formation, I have stated, that I conceive the hills owe their outline, presenting to the north an abrupt escarpment resting on a slope, and to the south an inclined plane, to the agency of volcanic forces. In the Karee river, near Bhooj, these b[illegible]s have been disturbed to an extent which defies representation. Near the village of Jarra, on the borders of the Runn, a bank affords a good example of the manner in which this upheaving power has acted. The laminated beds (upper secondary formation) being of a loose earthy character have yielded to the disturbing agent; whilst the overlying compact stone has broken short off, and presents a wall of rock, split by such perfectly vertical lines, that at first sight I thought the stone was columnar.

The range of Roha-ké-Koss, composed of beds of the fourth or upper secondary formation, is a good example of disturbing action. It is situated between the villages of Joorun and Lodye, on the borders of the Runn, and extends nearly east and west for eight miles, presenting, to the north, a perpendicular cliff of sandstone, which rests on a sloping talus of laminated sandstone and slate-clay, and dipping at a high angle to the southward. About three quarters of a mile from this main range, and parallel to it, is a ridge of smaller hills, consisting principally of basalt, intermixed, in some places, with the same sandstone as that of the main hill; and which, in the banks of the nullahs at its base, overlies, the laminated strata. The space between the two ridges is composed of large broken masses of sandstone, covered by a thick bed of gravel evidently the detritus of the hills. In this instance, the strata of the Koss range dip towards the south; and, at a short distance to the north of it, we find a mass of basaltic or igneous matter, which probably raised the hills in its passage up, and established itself at their foot. Large basaltic dykes, disturbing the strata through which they pass, are observable in many of the river banks in the immediate neighbourhood.

The beds of nummulitic limestone, on which Luckput stands, present, as before stated (p. 321), most decided marks of elevatory movements, consisting of a central platform of horizontal strata, with inclined beds on the flanks.

Another most striking example of the effects of igneous action in upraising hills, occurs in the nummulitic limestone, near the village of Punundrow; and the phænomena are so strongly marked, that they deserve a detailed description.

On leaving the village of Korah, in the north-west department of the province, and proceeding westward, a range of hills is entered, of small altitude, but covering a considerable area. It is composed of a confused assemblage of basaltic cones in broken columns, or rather of a number of sugar-loaf-shaped masses piled one on the other. The surface of the hills is covered with fragments of a hard greenstone, the crystals of felspar being numerous. The perpendicular banks of the nullahs and ravines which intersect this range, present, in some places, entire sections of the columnar basalt; whilst others consist of a friable, sandy clay, disposed in horizontal, thinly laminated strata of every shade of black, red, and yellow, to white; and associated with it is a beautiful purple loam. The basalt sometimes overlies these beds, sometimes forms dykes in them; and one side of the ravine frequently consists of this variegated loam, and the opposite of basaltic pillars. In many places the ground has an altered appearance; the ironstone, of which large quantities are lying about, appearing partially fused, and the clays or variegated marls variously acted on, and always accompanied by dykes of basalt. These hills continue about eight miles from Korah to the village of Ukri, where they gradually decline into a plain, throwing off numerous ridges or forks. About three miles distant, a solitary hill, with a flat but uneven top, called Baboa, rises out of the plain. To this hill I wish to draw particular attention; and the foregoing account of the basaltic range has been given as necessary to a proper understanding of it.

The first part of this plain is composed of thick beds of gravel, but further westward it consists of the nummulitic formation. Out of this soil rises the Baboa hill, composed of hard limestone, full of marine remains. One of the forks projecting from the basaltic range reaches to within half a mile of the hill, the ground near it being strewed with small fragments of igneous rock.

The cause of the elevation of this hill is, in my opinion, distinctly visible in the banks of a river which passes by its western base. They are from 20 to 30 feet in height, and are composed of white calcareous marl, covered by a thin bed of gravel. Immediately opposite the hill, these beds are cut through by a dyke of very compact dark green basalt, forming, towards the river, a wall about eight feet high ; its base being hid by a talus of gravel. In several places on each side of this dyke, which is about 50 yards in breadth, independent masses of igneous rock break through the marl. They are principally of a blunt, conical form, capped with portions of the marl, and consist of spheroids of basalt, which desquamate in concentric layers, precisely resembling scales of iron. At a short distance up the river, or northward, this marl is covered by a stratified series, dipping at a high angle to the north, and consisting of a yellowish marl, with small imbedded fragments of lignite, covered by a bed of blue clay, containing also fragments of lignite and quantities of an olive-brown earth, in which small pieces of either amber or mineral resin are inclosed. Above this bed is a stratum of red sandstone ; and the whole is covered, at its lower extremity, by a thick bed of gravel. These inclined beds reach the level of the water about 400 yards from the basaltic dyke, beyond which the marl again appears in horizontal beds. Southward of the dyke, the change from the broken part to the undisturbed horizontal strata, is much more abrupt, occurring within a very short distance. On the top of the bank adjoining the south end of the dyke the stratified beds of blue clay, &c. are horizontal.

From the above description it appears, that the only place in which the basalt is exposed, is directly under the hill, no trace of it being discernible either above or below this spot ; also, that the most compact and extensive mass of basalt is exactly under the highest part of the hill ; and that detached masses of igneous rock present themselves, with large portions of the marl adhering to them. A series of stratified beds is also noticed rising from the north towards the hill, meeting the surface at its foot, and is again found in a horizontal position just south of the hill. All these facts surely prove, that the hill must have been elevated by an outburst of igneous matter, which was probably a branch from the basaltic hills to the eastward ; one of its forks reaching within half a mile of the spot.

Quantities, of what I believe to be frothy or foam lava, being a brownish black substance, very vesicular or spongiform, extremely light, and somewhat similar to a very porous cinder, are found adhering to the marl, and in the rubble of the bank.

Large blocks of the shelly limestone, composing the summit of the hill, are scattered about its sides and base; and some of them, my guide informed me, fell during the earthquake of 1819; and the abrupt and steep sides are, no doubt, due to the action of water. Numerous fossils are found lying about, characteristic of the nummulitic limestone.

I have minutely described this hill, in the hopes of impressing others with the same belief as myself, of the cause of its elevation.

Near the village of Nambye, in the Charwar range, a basaltic dyke traverses beds of thinly laminated slate-clay and layers of limestone slate. In the immediate vicinity of the dyke the strata dip in all directions, and form even anticlinal lines. The basalt is very hard, compact, and of a dark blue colour, and presents irregular masses, without the slightest approach to a columnar structure.

Distinct Periods of Volcanic Eruption.—That the volcanic eruptions have occurred at many distinct periods, is also evident, from the different formations with which the igneous rocks are associated, and from the variations in their characters. Thus, in the same section, the lower part frequently consists of large, rolled, or water-worn masses, whilst the upper portion is columnar: in other places the basalt alternates with a calcareous grit or coarse limestone, having a tabular structure, but always distinctly stratified, and very brittle, so as to present perpendicular banks. This limestone is generally associated with basalt, where the latter is raised into hills; and from the fact of *angular* pieces of basalt or igneous matter being imbedded in it, would incline one to believe that, in such cases, it must be contemporaneous, though it often regularly alternates with it. In other places the basalt is interstratified with a pure crystalline limestone or travertin.

The principal mass of igneous rocks lies towards the southern department of the province, and forms a group of hills called the Doora range; the intervening spaces and the ground at their southern base generally assuming a porphyritic structure. The northern parts of the range have, for the greater part, a flat, smooth outline; but in the interior of the group are many clusters of small, conical hills, arranged round a circular space, inclosing a kind of hollow. The sides of these cones are very steep, and invariably present innumerable horizontal lines, forming rings resembling narrow paths. The surface being covered with basalt, in very small pieces, is totally devoid of vegetation, and has precisely the appearance of a newly-laid macadamised road. Their interior, however, has a much more solid construction, as is well seen in numerous deep clefts and ravines with which the hills are in all directions intersected.

One of these ravines, near the village of Doonee, is 50 or 60 yards broad, and nearly 100 feet deep; and its perpendicular sides are composed of compact columnar basalt of a greenish grey colour; the columns being perfect polygons, and of a very large size. This rent must have been formed by some convulsion, as it reaches nearly to the summit of the hill; and the only water that could ever have flowed down it being that which falls on its sides and bed, and must be very little.

Alternations of Basalt with Strata of the Upper Secondary Formation.—Near Nurra, on the borders of the Runn, a hill called Jogé-ki-bit, basalt alternates with slate-clay, limestone slate, slaty limestone, and a laminated loam. The strata dip from 40° to 50° to the north, which being at a higher angle than that at which the hill itself rises, it causes them to crop out; the surface being also broken into several distinct ridges. The igneous rock alternates three times. In one instance it underlies a stratum of hard slate-clay; in another it occurs between a coarse, soft sandstone, and slate-clay, and sandstone slate; and it also forms the conical summit of the hill, which is not more than ten feet in diameter. The basalt desquamates in flakes, but has a centre of compact rock. The same inclination of the beds is continued through the hill.

Alternations of the Calcareous Grit with Basalt.—At the village of Doonee, above mentioned, the banks of the river present a perfectly perpendicular wall, from 15 to 20 feet high, and are composed of the calcareous grit, or coarse limestone alternating with basalt, in the following order: first, grit; then a horizontal bed of rounded pieces of basalt; and next, another stratum of the grit, 15 feet in thickness; the whole being covered by the basalt forming the hills.

Another good example of this alternation is near the village of Keroee, at the eastern limit of the formation. The banks of a river are here composed, in some places, of the basalt forming the Doura range; and in others, entirely of the limestone grit, which in one place overlies the basalt, but forced up into anticlinal lines, as if the igneous rock had been protruded from below; the broken state of the strata showing that it was not originally deposited in this position. The bed of the river at this place is entirely composed of basaltic columns; their horizontal sections forming a regular pavement; and large masses of the columns, occupying from 200 to 300 square yards, and being about eight feet in height, remain every here and there, similar to a field of corn partially reaped. The columns are very regular, generally four-sided, with smooth, even surfaces, and are composed of a hard, compact, dark blue basalt.

Another instance of the junction of the limestone grit with the basalt is near the village of Choolree, a little to the westward of Kaira. The basaltic range is completely divided by a narrow ravine, in which the two rocks appear in contact, the limestone being broken in all directions. One side of the ravine presents a perpendicular cliff, of nearly 80 feet in height, of irregular columnar basalt, overlying a bed of rounded masses of the same, though the opposite bank is composed of the limestone grit. Advancing through the Pass, the basalt terminates abruptly, and is succeeded by the limestone grit, which forms both sides of the ravine. Further on, the basalt again appears in the form of a dyke; beyond which is the grit, once more succeeded by a dyke of basalt, forming, at this extremity of the Pass, both banks. Where the dykes of basalt occur the limestone lies in immense masses, evidently broken off at the time of the projection of the upper bed of igneous rock; being itself of subsequent formation to the lower basaltic bed of rolled masses. This is very distinctly shown at one part of the Pass; and it should be mentioned, that the bed of the ravine consists throughout of irregular or broken basalt.

The intervening spaces and the ground at the base of these hills are composed, for the most part, of a red clay much resembling brick, a variety of it being amygdaloidal, of a darker colour, extremely hard and tough, and containing quantities of calcareous spar, chalcedony, rock crystal, &c.

In some places it forms low ranges of hills of a hard rock, of a dingy red colour, thickly interspersed with cylindrical kernels of zeolite, with a light green coating, some of them dividing into two parts. Other specimens contain numerous crystals of felspar; and, in many instances, all the mineral substances have disappeared, leaving a vesicular mass. Occasionally, thin beds or layers of calcareous spar, of a leek-green colour, are met with, also of rock crystal and chalcedony in all its varieties. The surface of the plains is covered with fragments of these minerals, derived from the disintegration of the amygdaloids, which are rapidly affected by exposure to air and water. Some of the sides of the hills are covered with heaps of rock crystal, as if cart-loads had been purposely thrown down.

Alternation of Basalt with Travertin.—A very good example of successive eruptions of basalt occurs near the small village of Wurrowsow, on the south-western flanks of the Charwar range. This point must at one period have been a lake, it being now a dead flat, about 4½ miles in diameter, and surrounded by low but steep hills, whose surfaces are covered with small fragments of basalt; its general level is about 20 feet above the ground to the east of it. The soil consists of alluvial matter and fine gravel, totally different from the sandy plain by which it is bounded; but its most interesting feature is the basalt at the eastern outlet or break in the low surrounding hills. This mass of trap consists of perfectly polygonal columns about 25 feet in height, but broken into lengths, forming a series of regular steps, cut into a horse-shoe shape by a small stream, which discharges itself during the rainy season. The hills that flank it on each side are composed of a base of coarse sandstone capped by an earthy basalt, a dyke of which, 8 or 9 inches wide, has, in one spot, penetrated the subjacent sandstone.

The friable basalt forms the base of the fall. Above the columns the bed of the small stream consists of a loose, calcareous calc-tuff.

This section presents several interesting facts; as, from the alternation of basalt with the limestone or travertin, it is evident, that a considerable time must have elapsed between the igneous eruptions. The variety in the texture of the limestone or travertin may be accounted for by supposing, that the waters under which it was deposited were sometimes perturbed, or rendered muddy by a flood; but at other seasons clear, when a pure calcareous precipitate would take place. The basalt forming the columns is very hard, compact, of a dark blue colour, and smooth surface; and it may be traced to some small hills northward of the spot.

Near this place the surface has been affected in a manner worthy of observation. Every here and there, a small spot, varying in size from 3 to 20 yards in diameter, has been raised into a convex form; the pavement, that covers it, consisting of tabular plates of slaty sandstone, broken into small masses; and the fractured lines generally radiating, though in an irregular manner, from a centre. In some places the tops of these little globular elevations have been removed, leaving a regular circle of stones, whose bounding lines are disposed like the stones of an arch. In other instances they assume a more conical shape, resembling small hillocks, from the upper part of which the outer coating or tabular masses have generally fallen away. When they are of a larger character, the whole presents a heap of broken masses of rock.

Denodur Hill, an extinct Volcano.—Of the detached hills, the elevation of which I conceive to be due to volcanic influence, the principal is that called Denodur, and is situated near the shores of the Runn. It is the largest and highest hill in the country, and is evidently the remains of an extinct volcano, an irregular crater being still visible. In the north side is a large gap, reaching nearly to the foot of the hill, but partially blocked up by a lower ridge, or a kind of traverse. Its western flanks are composed of a series of ridges of laminated clay and loam, interspersed with flat, angular fragments of slaty sandstone and slate-clay. The surface of some of these ridges is smooth, consisting either of thin slabs of slate-clay, or of thicker slabs of a very compact, crystalline, and slightly calcareous stone, the same as that which overlies the laminated series, and forms the walls on the Runn, &c. Near the base of the hill and for more than two-thirds up its side the construction alters, being composed partly of a loose sandstone, and partly of the calcareous grit, containing imbedded, angular fragments of basalt; the uppermost part is a perpendicular wall of basalt, which, apparently, continues all round the top. A stream of very compact basalt runs past its north-western flank, and in other places. Numerous small conical hills, composed of horizontal layers of limestone grit, or of basalt, are scattered over its sides, and its base is covered with a thick mould, formed of decayed vegetables, with earthy matter. Nowhere did I find any traces of recent disturbance, although the people of the neighbourhood, particularly the Jogees, or religious devotees, who inhabit a temple on its northern flank, asserted that fire issued from it during the earthquake of 1819. If it did, there would, of course, be some signs of it remaining; but I was unable to penetrate into the interior of the hill, owing to the dense Bauble Jungle, or crooked thorn tree with which it is covered.

Not far from this place, and adjoining the village of Nuckutrana, is a hill of some size, called Ungia-soorud, the elevation of which has also been effected by volcanic agency. The flanks and base are composed of a very loose, friable, calcareous sandstone and grit, apparently stratified, but inclined at all angles; and the remainder consists of very compact basalt. The hill is divided into two parts by a narrow, tortuous cleft, the sides of which are nearly perpendicular, and composed of irregularly triangular prisms of basalt. The cleft is not more than four feet wide at the bottom, though it is somewhat broader at the top; and as it passes completely through the hill, we must suppose the whole to be similarly composed.

All the other numerous isolated hills scattered over this part of the province, including that called the Nunnaw, next to Denodur, appear to be similarly constructed.

The hill called Lecka, deserves particular notice. It forms one of a group of hills on the borders of the Ruun, at the north-western extremity of the province, and is composed of two portions; one consisting of stratified beds of sandstone; and the other wholly of basalt, in irregular, triangular columns. The beds of sandstone are horizontally disposed, and of various colours and textures; the lowest stratum being a coarse, brown, quartzose grit. The igneous rocks crop out in various places near this spot, forming a cluster of small hills between it and the Jooria range; the intervening spaces being broken in the most confused manner.

Recent Outbursts.—Having given as many examples of the elevatory effects of volcanic action as my space will admit, I shall conclude my account of their phænomena with a description of some igneous outbursts of, apparently, a very recent epoch. The principal one occurs at the village of Wagé-ké-Pudda. The spot which has been acted on is a rather high table-land, composed of the nummulitic marl, and is flanked by low, irregular hills of ironstone and gravel, called by the natives Kara Rurraw. The first view of it, is very striking. Conceive a space of about two square miles, blown out into a flat basin, the sides being broken into fissures, with craters, ravines, and hollows; and the interior, or bed of the basin, interspersed with hillocks and cones of every variety of colour, black, red, yellow, and white, and with patches of cinders, similar to the refuse of a furnace; the whole looking as fresh as if the igneous agents were still in operation.

The surface of the table-land immediately surrounding the blown-out space, is covered with a burnt ironstone, divided into irregular cells, similar to Septaria; below which are steep banks, 40 to 50 feet high, consisting of comminuted particles of clay, sand, gravel, scoriæ, and small angular pieces of basalt; the whole being loose, and having a dry and brittle feel.

Within the centre are several small craters, or circular spaces, surrounded by walls of basalt. None of them are perfect circles, being broken through by watercourses; but one has about two thirds of its circumference complete, the sides of which, about forty feet high, are in the upper part quite perpendicular, and consist of very compact basalt, of a columnar structure; while the lower ten feet present a talus, composed of volcanic sand, and scoriæ in very thin laminæ. Below the columnar basalt is a bed of a friable variety, three feet in thickness. In some parts the columns are capped with a thin band of ironstone. The interior of this crater is about 80 yards in diameter, and consists of volcanic sand, with imbedded angular fragments of basalt. The most perfect of these craters, or circular spaces, are generally hid from view, being approachable only by the narrow ravine forming the outlet of the watercourse which cuts through them. The basalt varies greatly in texture and general appearance: in some places it is columnar, exceedingly hard and compact, in others it contains imbedded crystals of felspar, and it occasionally presents the structure and texture of an amygdaloidal clay. Some varieties also consist of concentric layers of a kind of brittle, clayey substance, inclosing a nucleus of hard rock; the whole being imbedded in a mass of clay, which looks as if a number of small roots were entwined about it. All the varieties are frequently found in the same bank or hillock.

Several other small basins have been blown out in the surrounding table-land, forming inverted cones, about 15 or 20 feet in depth; and are composed of the same materials as those just described. Many of them consist entirely of small, brittle particles, of a pale yellow colour, evidently sulphuric. The clay has, in various places, been burnt into a perfect brick; and the marls, or sandy clays, are frequently of a beautiful bright purple. Quantities of talc, or mica, lie scattered about, twisted and contorted into a variety of shapes; and some of the iron ore which covers the surface, appears to have been partially fused, consisting of a spongy, vesicular mass. The whole has the appearance of having been for some time subjected to considerable heat, and then suddenly blown up. The cones and banks of loose volcanic scoriæ must be yearly washing away; and it is difficult to conceive, that the walls of solid basalt forming the sides of the craters, can belong to a similar period, having all the appearance and texture of very old basalt; but it is possible that a recent eruption may have taken place in the site of one of a more ancient date, thus presenting a mixture of old and recent volcanic products. If it is true, that basalt owes its columnar structure to its cooling slowly under a great pressure, it is impossible that these masses of columnar basalt and the loose cones of scoriæ can be contemporaneous.

In the nummulitic marl forming the banks of a river which flows past this patch of blown-up ground, is a stratum of earth containing small nodules or rounded masses, of a pale yellow colour, translucent and brittle, and which burn with a bright flame, giving out a strong aromatic odour. It is contained in a dry, olive-brown earth, so light as to float in water.

Numerous *Echinodermata*, and other fossils, are found on the table-land, and some of the fields are thickly strewed with casts of a Turbinella of a very large size, the external shell being always wanting. On breaking them, small fragments of igneous matter are found in their interior.

In the table-land just south of the outburst, is a large fissure, about a quarter of a mile in length, 40 yards broad, and 40 or 50 feet deep. One extremity communicates with the river, and the other is rounded, or formed into a basin shape. The sides are perfectly perpendicular ; and it is clearly an opening in the ground, there not being the slightest indication of anything of the kind, until directly at its brink. I was informed by a native of the village, (the only present inhabitant,) that smoke issued from the outburst about twenty-two years since ; but little dependence can be placed on the statements of these people.

Another similar, but smaller, outburst occurs about three miles south of Mhurr, near the spot in which, in my account of the tertiary deposits, I mentioned that a large basaltic dyke crosses the river. The space here blown out, does not exceed 100 yards in diameter, and 15 feet deep, consisting of similar cones of volcanic scoriæ, and comminuted particles, as above described ; but there is no trace of any basalt nearer than the dyke in the river.

From what I have now detailed, it appears, that igneous action has affected all the formations of which the province is composed ; and it will also appear, by the following details, that the Grand Runn, the most remarkable feature of the country, owes its peculiar characters to volcanic action.

THE GRAND RUNN.

With a short account of this large and singular tract, I shall conclude the paper. It has been described by Captain Burnes, in a memoir in the library of the Royal Asiatic Society; and referred to, at considerable length, by Mr. Lyell, in his "Principles of Geology."*

This tract, containing an area of upwards of 7000 square miles, exclusive of the space occupied by the Bunnee, and the islands of Puchum, Khureer, &c., is, perhaps, unparalleled in any known part of the globe, as it may be said to be placed on a level between land and water. It is dry during the greater part of the year, when its surface consists of a sandy flat, totally devoid of vegetation ; but, perhaps, on account of its saline nature, always sufficiently moist to prevent its particles being drifted. During the prevalence of the south-west winds, however, so much water is blown up its eastern inlet by the Gulf of Cutch, and, at its western extremity, by the eastern branch of the Indus, as to cover its whole surface; augmented by the freshes, which, at the same time, come down the Loonee and Bunass rivers, and the numerous small streams which intersect the northern coast of Cutch. At those seasons, the Runn has all the appearance of a sea, and is passable only on camels, and, in some seasons, with difficulty. It has been described as the dried-up bed of a sea; but it is not easy to account for its drying up, unless we suppose a general depression of the ocean. We must, therefore, look to other causes.

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* 5th Edit., vol. ii. p. 183 *et seq.*

In several parts of the world, particularly in the Baltic, there are undeniable proofs of a gradual rising of the land; and, in time, parts of that sea might be converted into a tract similar to that of the Runn.* It does not become me to inquire whether this gradual elevation is due to a series of so minute elevatory movements as to be unnoticeable, except from the effects which subsequent measurement proves them to have produced, or from a gradual expansion by volcanic heat. But in Cutch we have evidence of movements within a very late date, and every reason to believe that similar ones have occurred at various periods. The earthquake of 1819 is known to have produced a remarkable change on the western extremity of the Runn, by throwing up a mound 50 miles in length, 16 in breadth, and 18 feet high; and by depressing an adjoining tract, so as to convert it, from a cultivated district, into a large salt lagoon. As the changes in level, thus effected, have, however, been detailed in other papers, I shall merely observe, that when I was at Luckput in January, 1834, very little if any change had occurred since Capt. Burnes' visit, in 1828; except that the Sindians had repaired all the bunds across the river, and thus, by preventing further supplies of fresh water, the lagoon had assumed much the same appearance as previous to the freshes of 1828.

I was also informed by a boatman, who constantly plied up and down from Ullah-Bund to the sea, that between Sindoo and Sindree, there is a bank, six miles broad, covered by only one foot of water; and as there is no channel through it, the boatmen are obliged to get out and haul the boats across the bank, after which they follow the windings of the channel to Ullah-Bund. It would therefore appear that this portion could not have been so much sunk as that around Sindree, and between it and Luckput.

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* See Mr. Lyell's Memoir, on the proofs of gradual rising of the land in Sweden. Phil. Trans. 1835, p. 1 *et seq.*

I was also assured that pieces of iron and ship-nails have been thrown up from fissures in the Runn; and Capt. McMurdo* mentions a boat which had been buried under 15 feet of alluvium, having become exposed in a mud-bank, near the village of Wuwania, on the Kattywar side of the Runn, or where it joins the Gulf of Cutch.

The number of places still pointed out as Bunders, or quays, together with the large stones formerly used as anchors, one of which still lies on a small elevation on the Runn, not far from the Puchum Island, and the confident assertion of all the inhabitants on its coast, tend to confirm the opinion that the district must once have been covered by a navigable body of water.

Some parts of the shores have precisely the appearance of having been recently deserted by the sea. This is particularly the case near the village of Charee, which is separated from the Runn by a low range of hills. To the northward of this range is an inlet, about one mile and a half in breadth, and it looks precisely like a small creek or bay from which the tide has just ebbed. Its surface is composed of smooth, whitish clay, with numerous scattered gravel banks, the ends of which have been worn round, and the sides present perpendicular or overhanging banks. Several masses of crystalline sandstone also rise suddenly out of the bed; and some of them consist of immense fragments, which look as if they had been piled one on the other, and have a strange effect from a short distance. Beyond the inlet is another range of hills of the same description, but it is more broken and confused than any other in the country. In some places, the upper stratum of hard rock has been thrown into a position like the roof of a house; in others, it precisely resembles a ruined fort with towers on a hill; but the greater part of the stratum is a confused assemblage of huge fragments of rock. Northward of this range, and separated from it by a narrow belt of the Runn, is a steep conical hill, called Keera, 600 or 700 feet in height, consisting partly of the same materials as the others, and partly of basalt; and it appears to have been formed in a similar manner to the hill called Ungursoorud, before described, and others of that class. It is also more than probable, that the peculiar, fractured appearance of all the ranges is due to the same cause acting at the same period.

Supposing the bed of the Runn to have been raised by a series of violent movements, such as must have upheaved the Keera, and its surface to have been broken, and covered with fragments of rock, its present level outline may be ascribed to subsequent operations. The Runn is bounded to the north, as already stated, by the Thur or Little Desert, a district composed entirely of sand. The Loonee and Bunass rivers also flow through a sandy soil, as do many other streams which enter from the Cutch side. Now, during the periodical floods, vast quantities of sandy alluvium must have been brought down by these rivers, deposited at their mouths, and washed thence and spread over the surface of the Runn by the sea-water annually blown up at its eastern and western extremities. This operation, repeated yearly, would fill up all inequalities, and produce in time a level surface. It is probable, however, that the present state of the district may also be, in some measure, owing to a gradual rising of its bed, as it is only to such operations that some of its shores, as those of the inlet above mentioned, can be ascribed.

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* Extract from Captain McMurdo's MS. memoir on Kattywar, in Captain Burnes' Travels in Bokhara, vol. iii. p. 329, *note.*

There are also many facts to prove, that this tract has been elevated at very different periods. The high hills bordering its southern shore are, as before stated, composed principally of the laminated series, and their surfaces are covered with Ammonites, Nautilites, Belemnites, and other fossils of that geological period; whereas along its immediate line of shore, there are generally low ridges, composed of rocks full of marine remains of a totally different character, many of them belonging to existing species. Numerous small rocky islets, consisting of shells agglutinated into a solid mass, occur in various parts of the Runn, and are barely raised above its present level. They are probably merely the higher portions of large tracts, the lower parts of which are covered by sediment.

Natural Walls on the Runn how formed.—Still more striking instances of the effects of upheavement, since the Runn assumed its present characters, are exhibited in the detached, elevated masses of rock which I have called the *Natural Walls* on the Runn.

They consist of disconnected portions of rock rising abruptly from the surface of the Runn, and presenting a smooth, vertical wall, occasionally upwards of thirty feet in height, and in one instance upwards of two miles in length. Some of them resemble domed or vaulted buildings, the reversed side consisting of a talus of broken fragments of rock and soil. In one place these walls form a semicircle about 500 yards in diameter, both walls sloping outwards. That the walls have been uplifted into their present form is quite evident, first, from the stones being all on end, that is, with the grain in the direction of their present position, and peeling off in scales down the face of the wall; and secondly, from my having met with the same phenomena on a smaller scale, in other parts of the country, where the slabs of rock are at all angles, and even, as those before mentioned, turned over. It should be noticed, also, that the borders of the Runn, near these walls, are composed of friable beds of the laminated series, covered with thick tabular masses of hard sandstone, precisely similar to those forming the walls.

Had they been uplifted during the permanent prevalence of the waters, the sloping talus of earth and fragments of rock, with which they are all backed, must have been washed away. It should be stated, that these examples are situated on ground now almost recovered from a state of Runn; some parts having been sufficiently augmented by means of the sandy alluvium, washed down from the neighbouring hills to support vegetation; whereas the isolated rocks, several of which rise out of that part of the Runn, and are still subjected to inundation, have no detritus or talus, but present smooth walls of perpendicular rocks. I could never perceive any water-marks on them, nor any remains of marine testacea, which might occur, had the sea ever washed the present level of their foot. It is probable that their original base lines have become obliterated by the sediment which must have accumulated round them in course of time, and which forms the existing surface.

A very good example of a similar wall occurs in the centre of the province, near the village of Rampoora; it is a ridge of coarse sandstone about 300 yards in length, and from 10 to 15 feet in height, the stones being evidently placed edgeways, and in so regular a manner as to resemble precisely an artificial wall. It rises from a base of the same sandstone, and on one side it is nearly flat, but broken into masses, while on the other side are heaps of stone, broken and confused, and the interstices are filled with sand and small trees. At the extremity of the wall the stones slope up like the end of a roof. In the immediate vicinity of this wall is a small range of basaltic hills, striking however at right angles to the direction of the sandstone ridge.

Some of the rivers which flow towards the Runn from the Cutch side are lost in the sand at their mouths; though at a short distance up the bed of the river, the stream runs freely. It would thus appear, that at these spots, the bed of the Runn has been increased, by the sediment, probably, brought down by the stream; but so loose is the soil, that the water soaks into it and even flows under it, instead of wearing channels. This phenomenon is observable in the sandy beds of many of the rivers in the province. The stream may be noticed running with some rapidity and of a sudden to cease, the bottom of the river presenting a smooth sandy surface; but a mile lower down the water again issues and continues its course; the intervening parts being sometimes quite hard and dry; in others forming very dangerous quicksands.

The natives have various traditions that the drying up of this sea was sudden, and that boats were tossed on the land and wrecked; they pretend also to assign a date to this event, but their accounts differ so materially and are so vague, that not the slightest reliance can be placed upon them, except to the general fact.

It is evident that the Runn could not have been drained by the bursting of its boundaries, at least since it was deep enough to be navigable; because its present surface, notwithstanding the sediment which yearly accumulates on it, is even now so little raised above the sea's level as to be flooded by the mere effects of the wind; but the most probable supposition is, not that it was ever a detached inland sea or lake, but that it communicated with the ocean by its present outlets, and that its bed has been raised, partly perhaps by a gradual movement, and partly by violent upheavements during earthquakes. Even such marked changes of level as the raising of Ullah-Bund, and the sinking of the ground near the large town of Luckput, would have passed unrecorded but for the accidental circumstance of the district having been visited by a British officer. Other portions of this vast area, the greater part of which is never traversed by man, may have been similarly affected at that time, and yet the changes remain unkown.

Successive Marine and Freshwater Beds.—The submerged tract near Luckput, or Lake of Sindree, may, I think, illustrate the manner in which successive marine and freshwater deposits may be produced. This tract was at one period a richly cultivated district, periodically flooded by a branch of a great river, and produced large quantities of rice. In this state numerous land testacea no doubt occupied it, and were mixed with the remains of fluviatile species brought down by the floods. The bones of animals used in agriculture, and those of various domestic species, also the remains of broken pottery, perhaps coins, and other proofs of civilized life, might likewise have been imbedded. Suddenly, owing to the damming up of the river by the Sindians, the supply of fresh water ceased, and the tract was no longer cultivated or inhabited. Some time after this an earthquake occurred, uplifting one part and depressing below the level of the ocean another, which was immediately converted into a salt lake. A perfectly new description of deposit and organic remains must then have been accumulated, consisting wholly of marine animals, principally such as inhabit shallows and tideways. Again, owing to the sudden melting of the snow on far distant mountains (the Himalayahs) the waters of the river came down with such force as to burst all the bunds built across it, as well as that thrown up by the earthquake, and covered the tract with fresh water, or perhaps with fresh at its upper or northern extremity, and brackish at its southern near the sea. Supposing this state of things to have remained for some time, the river continuing to pour its water into this lagoon, another change would take place in the description of the sedimentary deposit. Once more the bunds were erected across the river, the supply of fresh water ceased, and as that on the lagoon evaporated, the sea again flowed in and converted it into a salt lake, which is its present state. All the above changes are known to have occurred; and it is easy to suppose that if the shallow part at Sindoo were slightly raised above its present level, thus shutting out the sea, the part around the Fort of Sindree would be converted once more into dry land. If, therefore, at any future period, the river should again cut a channel, the banks might present various, regular beds alternately enclosing marine and freshwater exuviæ, the latter being also associated with land productions.

The ruins of one of the towers of the Fort of Sindree remained, when I visited Luckput in 1834, and in all probability now stand as a monument of the changes, which are daily taking place on the earth's surface.

Conclusion.—In concluding this paper, I have only to observe, that I have throughout endeavoured to describe facts as they appeared to me at the time I examined them, without regard to any particular theory; and if I have failed in making my descriptions intelligible, I have only to plead the difficulty of having had a great deal to describe in a limited space. As the country to which this memoir relates is, however, unfortunately from its geographical position, beyond the reach of general observers, I am induced to hope, that this sketch, however imperfect, may be found to possess some interest.

For the arranged list of fossil shells, given in the Appendix, as well as for all my information on that subject, I am entirely indebted to Mr. James De Carl Sowerby, who had my specimens (now in the cabinets of the Geological Society) for some time in his possession for examination.

NOTE.—In conformity with our practice of extracting from scarce or expensive works such articles on matters of Science connected with this country, as appear in European Periodicals, we have taken from the Transactions of the Geological Society of London the foregoing articles. We wish we could give copies of all the figures of fossils which accompany the original text, forming a most valuable addition to the palæontology of India, but their number precludes us from so doing—the difficulties and expence attending the execution of so great a number of lithographs being greater than the resources of this Journal could meet.—ED. MADRAS JOURNAL.

APPENDIX.

SYSTEMATIC LIST OF ORGANIC REMAINS, THE PLANTS DETERMINED BY MR. JOHN MORRIS, AND THE REMAINDER BY MR. JAMES DE CARL SOWERBY, A. L. S.

The fossils considered as belonging to previously described species, are distinguished by a reference to the work in which they were first noticed; the new species are described in the explanations at the end.

Class, Genus, and Species.	Formation.	Locality.	Remarks by Capt. Grant.
Plantæ.			
Ptilophyllum acutifolium..........	Sandstone, Clay with Coal.	South of the Charwar range.	
——— *Cutchense*.... ...			
Lycopodites affinis......			
Fucoides (*Codites ?*) *dichotomus*.			
Stems of Equisetites or a Monocotyledonous Plant............			
POLYPARIA.			
Lycophris Ephippium .... (p. 321 *Orbitolites*)	Nummulitic group.	Baboa Hill and Wagé-ké-pudda.	Very abundant.
——— *dispansus*............	...........Ibid..........		
RADIARIA.			
Crinoidal stems	Upper Secondary.	...........Charee....... ..	Found on hills near Charee with Ammonites and other fossils.
Echinus dubius....................	Nummulitic group.	Baboa Hill, Wagé-ké-pudda.	
Galerites pulvinatus...............	...........Ibid.........	.....Baboa Hill	
Clypeaster affinis ?..... .... Goldfuss, XLII. 6.	.. ..Ibid..........	Ibid. and near Joongrea.	
——— *varians*..............	.........Ibid...	Ibid. and Wagé-ké-pudda.	

—— *depressus*	Tertiary	Soomrow	Found in great numbers, and similar in colour and form, to recent specimens, but flatter.
—— *oblongus* Lamk.	Ibid	Between Joongrea and Kotra.	
Spatangus obliquatus S. Buckl.? Goldf., XLVII. 6.	Nummulitic group.	Baboa Hill	Very numerous.
—— *acuminatus?* Goldf., XLIV. 2.	Ibid	Ibid.	
—— *elongatus*	Ibid	Ibid.	
ANNULATA.			
Serpula? recta	Tertiary	Near Kotra.	Bodies of similar form occur in vast quantities on isolated banks in the river near Kotra.
Siliquaria Grantii	Tertiary	Borders of the Runn.	
CIRRIPEDA.			
Balanus sublævis	Ibid.	Soomrow.	
CONCHIFERA.			
Pholadomya? inornata	Upper Secondary	near Charee	Found on some hills bordering the Runn, which have been much disturbed by volcanic action.
—— *granosa*	Ibid	Ibid	
—— *angulata*	Ibid	Ibid	
Amphidesma? ovale	Ibid.	Ibid.	
—— ? *hians*	Ibid	Ibid.	
Corbula lyrata	Ibid	Ibid.	
—— *trigonalis*	Tertiary	Borders of the Runn.	
—— *rugosa*	Ibid	Ibid.	
Tellina exarata	Ibid	Soomrow.	
Astarte unilateralis	Upper Secondary	Charee.	
—— *pisiformis*	Ibid	Ibid.	
Venus granosa	Tertiary	Soomrow.	
—— *cancellata*	Ibid	Ibid., Kotra.	
—— *nonscripta*	Ibid	Soomrow.	
Pullastra? virgata	Ibid	Ibid.	
Cardita intermedia? Brocchi, XII. 15.	Ibid	Ibid.	

Class, Genus, and Species.	Formation.	Locality.	Remarks.
Trigonia costata, var. M. C., LXXXV.	Upper Secondary	Charee	Found in the same hills with the Pholadomyæ.
—— *pullus*	Upper Secondary	Charee	Found in the same bed as *Trigonia costata.*
Cardium intermedium	Nummulitic group.	Baboa Hill.	
—— *ambiguum*	Ibid.	Ibid.	
—— *triforme*	Tertiary	Soomrow.	
Cucullæa virgata	Upper Secondary	Hubbye Hills	A pass in the hills between Hubbye and Joorun is paved with these shells imbedded in a hard rock.
Arca hybrida	Nummulitic group.	Baboa Hill.	
—— *radiata*	Tertiary	Soomrow.	
—— *tortuosa?* Linn.	Ibid.	Ibid.	
Pectunculus pecten	Nummulitic group.	Baboa Hill.	
Nucula tenuistrata	Upper Secondary	Hubbye Hills	In the same masses with *Cuc. virg.*
—— *? cuneiformis*	Ibid.	Charee	These shells form stony banks which project slightly above the bed of the Runn; also solid rocks in the Hubbye Pass.
—— *Baboensis*	Nummulitic group.	Baboa Hill.	
Pecten partitus	Upper Secondary	Hubbye Hills.	
—— *lævicostatus*	Nummulitic group.		
—— *Soomrowensis*	Tertiary	Soomrow.	
—— *articulatus*	Ibid.	Banks of the Runn.	
Plicatula pectinoides	Upper Secondary	near Charee.	
—— M. C., CCCCIX.	Ibid.	Katrore Hill.	
Exogyra conica M. C., XXVI., DCV.	Ibid.	Ibid.	
Gryphæa globosa? M. C., CCCXCII.	Tertiary	Kotra.	
Ostrea Marshii M. C., XLVIII	Upper Secondary.	Katrore Hill, Charwar range.	Found in a bank in the hill.
—— *carinata?*	Nummulitic group.	Charee.	

M. C., CCCLXV.			
—— *callifera ?* Lamk.	Ibid	Wagé-ké-pudda	Isolated banks in the broad river-bed near Kotra are completely covered with these oysters.
—— *orbicularis*	Ibid	Luckput.	Masses, 15 to 20 feet thick, composed of this shell are scattered in the bed of the river.
—— *angulata*	Tertiary	Kotra.	
—— *Flabellulum* M. C., CCLIII.	Ibid	Cheeosir	The banks of a river near Cheeosir are composed of a grit full of these fossils, and of a Cardium. They are generally distributed through the tertiary district.
—— *tubifera*	Ibid		
—— *lingua*	Ibid	near Joonagrea and Kotra.	
Terebratula intermedia, var. M. C., XV. 8.	Upper Secondary	Charee.	
—— *biplicata, var* M. C., XC. & CCCCXXXVII.	Ibid	Jooria Hill.	
—— *sella, var.* M. C., CCCCXXXVII. 1.	Ibid	Pass of the Hubbye Hills.	
—— *concinna ?* M. C., LXXXIII. 6.	Ibid	Jooria Hill.	
—— *nobilis*	Ibid	near Charee	Very numerous.
—— *dimidiata ?* M. C., CCLXXVII. 5	Ibid	Ibid, Jooria Hill	One specimen was found in gold-coloured oolite, in the highest part of the Jooria Hill on the borders of the Runn.
—— *major*	Ibid	Charee.	
Mollusca.			
Bulla lignaria, Linn	Tertiary	Soomrow.	From the lower part of the hills. The shells found in this position differ from those in the highest part of the same hills, and appear to have been deposited in the shores of the Runn since those hills were raised.
Neretina grandis	Nummulitic group.	Wagé-ké-pudda.	
Natica obscura	Tertiary	Soomrow.	
—— *callosa*	Ibid	Ibid.	
Globulus obtusus	Nummulitic group.	Bahon Hill.	
—— *? anguliferus*	Tertiary	Borders of the Runn.	

Class, Genus, and Species.	Formation.	Locality.	Remarks.
Solarium affine	Ibid.	Soomrow	Very numerous.
Trochus cognatus	Ibid.	Ibid.	
Turritella angulata	Ibid.	Ibid.	Very numerous.
—— *assimilis*	Ibid.	Ibid.	
Terebra reticulata	Ibid.	Ibid.	
Cerithium rude	Ibid.	Ibid.	Numerous, but imperfect.
—— *corrugatum*	Ibid.	Ibid.	
Fusus ? granosus	Tertiary	Soomrow.	
——*læviusculus*	Ibid.	Ibid.	
——*nodulosus*	Ibid.	Ibid.	
——, or *Murex hexagonus*	Ibid.	Ibid.	
Ranella bufo	Ibid.	Ibid.	
Rostellaria rimosa M. C., XCI., not Lamk.	Ibid.	Ibid.	
——*rectirostris*, Lamk.	Ibid.	Ibid.	
Strombus deperditus	Ibid.	Ibid.	
—— *nodosus*	Ibid.	Ibid.	
Cassis sculpta	Ibid.	Ibid.	
Buccinum pumilum	Upper Secondary ?	Mhurr.	Found in a mass of white marl.
Turbinellus bulbiformis	Nummulitic group.	Wagé-ké-pudda.	Found in vast quantities, and sometimes very large.
—— *affinis ?*	Tertiary	Soomrow.	
Mitra scrobiculata ? Brocchi	Ibid.	Ibid.	
——*fusiformis*	Ibid.	Ibid.	
Voluta jugosa	Ibid.	Ibid.	Among the most numerous fossils found at Soomrow.
——*dentata*	Ibid	Ibid,	
Cypræa depressa	Nummulitic group.	Baboa Hill.	
——*humerosa*	Tertiary	Soomrow.	

——*prunum*	Ibid.	Eyerau.	
——*digona*	Ibid.	Soomrow.	
——*nasuta*	Ibid.	Ibid.	
Seraphs	Nummulitic group.	Baboa Hill.	An imperfect cast.
Terebellum obtusum	Tertiary	Soomrow.	
Oliva pupa	Ibid.	Ibid.	Found in great quantities.
Conus brevis	Ibid.	Ibid.	Very numerous.
——*militaris*	Ibid.	Ibid	
——*catenulatus*	Ibid.	Ibid.	
——*marginatus*	Ibid.	Ibid.	
Belemnites canaliculatus ? Schlotheim	Upper Secondary.	Charee.	
——— ———	Ibid.	Ibid.	
Nautilus hexagonus ? M. C., DXXIX.	Ibid.	Ibid.	
Ammonites Herveyii, var. M.C., CXCV.	Ibid.	Ibid.	Ammonites are exceedingly numerous throughout the Upper Secondary district, and are generally loose on the surface. In the text (p. 3 8) eight species are mentioned as new, but on further examination two of them have been ascertained to be only varieties.
———*elephantinus*	Ibid.	Ibid.	
———*formosus*	Ibid.	Ibid.	
———*lamellosus*	Ibid.	Ibid.	
——— *Opis*	Ibid.	Ibid.	
———*arthriticus*	Ibid.	Ibid.	
ignobilis	Ibid.	Ibid.	
——— *corrugatus ?* M.C., CCCCLI.	Ibid.	Ibid.	
———*armiger*	Ibid.	Ibid.	
Nummularia acuta.	Nummulitic group	Luckput.	Nummularia are so abundant as almost to compose a large tract on the north-west frontier of the province.
———*obtusa*	Ibid.	Wagé-ké-pudda.	
Fasciolites, (Parkinson) elliptica	Ibid.	Ibid. Baboa Hill.	

Plants from the Sandstone and Clay, with beds of coal: pp. 312, 317.

Described by Mr. J. Morris.[*]

Ptilophyllum.

Stem—? Fronds pinnate; pinnæ closely approximated, linear, lanceolate, more or less elongate, imbricate at the base, attached obliquely; base semicircular or rounded; veins equal, slender, parallel.

We have ventured to form these fossils into a distinct genus, conceiving that the circumstances of the oblique insertion of the pinnæ and their overlapping each other at the base, are characters too important to admit of their being united to the genus *Zamites*, to which somewhat similar fossils have hitherto been referred; the *Z. pectinata* of the Fossil Flora belongs to this genus, and a careful revision of the fossil *Cycadeæ* may probably discover other species having this mode of attachment; from the structure of the frond they may, however, be considered to belong to *Cycadeæ*, and to differ from *Zamites* in the oblique insertion of the pinnæ at the base, and from *Coniferæ* by the absence of a primary vein in the pinnæ.

Ptilophyllum acutifolium.

Frond pinnate; pinnæ narrow, linear-elongate, acute at the apex.

This species differs from the *Z. pectinata* of the Fossil Flora, in its pinnæ being narrower, longer, and more acute; and more nearly resembles the *Polypodites pecteniformis* of Sternberg.

P. Cutchense.

Frond pinnate; pinnæ short, scarcely overlapping at the base, apex obtuse.

This specimen has been also referred to the genus from its pinnæ (although wider apart than in the other species) having apparently a rounded base; but the absence of all trace of venation in this fossil must render its correct determination very doubtful. It resembles in form the *Z. Bucklandii* of Sternberg, parts 5 and 6, t. 23, f. 2, or even *Z. taxina* of the Fossil Flora; and it might also be compared to some pinnatifid Polypodiums, as *P. plumula* and *P. taxifolium.*

It is much to be regretted, that more numerous and better-preserved portions of these specimens have not been obtained, so as to compare them more rigidly with the already known forms of fossil vegetation; for it is remarkable the analogy that some of them present to the Stonesfield slate plants.

Lycopodites affinis.

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[*] The plants are stated in p. 314 to consist of ferns and reeds, but when the Memoir was passed through the press the specimens had not been examined by Mr. Morris.

Stem ——— ? branches linear-elongate, leaves distichous, alternate, ovate-lanceolate, acuminate, adnate at the base.

This specimen has been referred to Lycopodites from its resemblance to the barren portions of *Lycopodium Jussieni* and *L. volubile*.

——— ———,

These specimens were probably portions of stems belonging either to *Equisetites* or some monocotyledonous plant.

Fucoides dichotomus.

Frond compressed? dichotomous; branches unequal, patulate, apex obtusely rounded.

Shells from the Upper Secondary Formation described by Mr. James de Carl Sowerby.

Pholadomya? inornata. Transversely elongate, ovate, gibbose, concentrically corrugated; beaks very near the anterior extremity; longitudinal ribs very obscure, rounded. Width 1¼ inch, length nearly 11 lines.

Loc. near Charee.

Pholadomya granosa. Ovate, subtriangular, gibbose, ornamented with four or five rows of transversely-elongated and but slightly-elevated tubercles; the anterior side nearly straight-flattened, the posterior produced; beaks very prominent. Length 2 inches, width the same.

Loc. near Charee.

Pholadomya angulata. Subtrigonal, gibbose, ornamented with four or five sharp ribs, which are most prominent near the edge; anterior side straight, nearly flat. Length and width equal; in some specimens 2 inches.

Ph. angulata approaches *Ph. Murchisoni* var. of Phillips. (Geol. of Yorks., Pl. VII. f. 9.)

Loc. near Charee.

Amphidesma? ovale. Transversely elongate, ovate, convex, slightly wrinkled, anterior side small, truncated, distinguished from the rest of the shell by a gentle depression; posterior extremity rounded, rather pointed. Length 11 lines, width 1 inch 4 lines.

Loc. near Charee.

There is no proof whatever that either this or the following belong to the genus *Amphidesma*; they are, however, very nearly related to *A. donaciforme* and *A. securiforme* of Phillips.

Amphidesma? hians. Transversely elongated, convex, slightly wrinkled ; sides gaping ; the anterior small, separated from the rest of the shell by an obscure depression ; the posterior rounded, a little flattened. Length 1 inch, width more than 1¾ inch · the specimen being broken we have not the measure complete.

Loc. near Charee.

Corbula lyrata. Rounded, triangular, convex, transversely ribbed ; ribs about 15, prominent, rounded ; posterior side of the larger valve formed into a distinct lobe, convex, nearly smooth—the beak of the same valve much incurved, the margin toothed. Length and breadth nearly equal, sometimes exceeding half an inch.

Occurs grouped in dense masses with *Trigonia Pullus*, a smooth *Uncula*, &c.

Loc. near Charee.

Astarte unilateralis. Transversely obovate, anteriorly truncated, convex, rather flattened and marked with 8 or 9 concentric rugæ near the beaks. Anterior side at right angles with the hinge line ; lunette concave, ovate, pointed. Width greater than the length, but variable in proportion, generally about 1½ inch.

Loc. near Charee.

Astarte pisiformis. Nearly globose, with pointed beaks ; marked with 8 or 9 sharp transverse ridges ; edge toothed. Length 3 lines.

Loc. near Charee.

Trigonia costata, var. This shell varies slightly both in form and markings—generally the form is between that of *T. costata*, Parkinson or M. C. t. 85 ; and *T. elongata*, of M. C. t. 431 ; which Lamarck, apparently with justice, considers to be but one species.

Loc. near Charee.

Trigonia Pullus (M. C. t. 508, f. 2, 3.) ? The markings on the posterior side are not so regular as in the English specimens, but there is no other difference.

Loc. near Charee.

(Fossils from the Upper Secondary Formation, Cutch.)

Cucullæa virgata. Transversely elongato-quadrate, with projecting incurved beaks, very convex, marked with many longitudinal irregular, sharp ribs ; posterior margin obliquely truncated. Length 1½ inch, width 2¼ inches.

Loc. Between Hubbye and Joorun.

Nucula tenuistrata. Obliquely oval, finely striated concentrically; beaks close to the anterior extremity. Length 4 lines, width 5 lines.

Specimens very imperfect, along with *Cucullæa virgata*

Loc. Between Hubbye and Joorun.

Nucula ? cuneiformis. Transversely elongate-elliptical, gibbose, smooth; beaks close to the anterior extremity, small, incurved. Length 6 lines, width 10 lines.

Loc. near Charee.

Pecten partitus. Broad, short-elliptical, depressed, marked with two concave radii, which divide the surface into three parts, both externally and internally, the lateral parts being flattened; concentrically and minutely waved, waves alternately larger and smaller; ears small, nearly equal. Length 6 lines, width 5 lines.

Loc. Hubbye Hills.

Plicatula pectinoides, (M. C. t. 409.). If this differ at all from the British species, it is in having rather more the habit of an *Ostrea*, which is apparent in the expansion of the edge.

Loc. near Charee.

Exogyra conica, (M. C. t. 26 and 605.). The few specimens most detached from the matrix appear not to be quite so deep as those figured in the Mineral Conchology.

Loc. Katrore Hills.

Ostrea carinata (Lam. Hist. Nat. VI. 216. M. C. 365) ? The specimens being generally much concealed in the stone or broken, the determination of the species is not possible; the most perfect individuals resemble the young state of *O. carinata*, but that species is so near in some slates to *O. greguria*, (M. C. t. 111.) and *O. solitaria* (M. C. t. 468), that fragments cannot be distinguished.

Loc. near Charee.

Ostrea Marshii, (M. C. t. 48). The *O. Marshii* varies so much in different localities, that we find no difficulty in referring this shell to that species, although the plaits are more numerous than usual.

This specimen is accompanied with an imperfect *Plicatula.*

Loc. Katrore Hill.

Terebratula intermedia, (M. C. t. 15. f. 8.) *var.* A small specimen, and rather more deeply plaited than most of the European varieties of the species.

Loc. near Charee.

Terebratula biplicata, (M. C. t. 90 and 437, f 2, 3.) *var.* A variety of this variable species found in the red chalk at Hunstanton, is precisely similar in form to our specimen, except that it wants the angle on each side of the beak which is here obscurely visible.

Loc. Jooria Hill.

Terebratula Sella, (M. C. t. 437, f. 1.) *var.* A rather longer shell than the British fossil, and deficient in the central plait which most generally occurs in full-grown individuals of that species.

Loc. Pass of the Hubbye Hills.

Terebratula concinna, (M. C. t. 83, f. 6.) ? A larger shell than the one figured in M. C. and not so neat, but hardly possessing any character sufficiently strong to mark it as a species; there are, however, rather fewer plaits.

Loc. Jooria Hill.

Terebratula nobilis. Tetrahedral, rounded, sharply plaited; plaits about 16, extending to the beaks, 4 or 6 of them much elevated along the middle of the disk; beaks small, adpressed; sides concave near the beaks.

A large handsome species; when young the general form is depressed, but the middle is even then much elevated. Length and width, each 1¾ inch, depth of the valves united, sometimes more than 2 inches.

Loc. near Charee.

Terebratula dimidiata, (M. C. t. 277. f. 5.)? Whether this be *T. dimidiata* or *T. inconstans*, (M. C. t. 277, f. 4.) is a question the specimens are not perfect enough to settle. The flattened form of the specimen figured agrees with that of *T. dimidiata*, but the beaks of our specimens appear too much incurved (perhaps from pressure) and so to approach *T. inconstans.*

Loc. Jooria Hill, and near Charee.

Terebratula major. Transversely obovate, gibbose, plaited; plaits angular, extending to the beaks, about 30, half of them on one side of the front slightly raised; beak of the larger valve prominent, slightly incurved. A larger species than the last, of the same family, well distinguished by its width and even surface. Length, 1¾ inch, width 2¼ inches, depth of the valves united 1½ inch.

Loc. near Charee.

(Fossils from the Upper Secondary Formation, Cutch.)

Buccinum pumilum. Ovate, pointed, transversely striated; spire small; whorls 4, smooth in the middle, slightly convex; aperture ovate, pointed at both extremities. Height 3 lines, diameter 2 lines.

Loc. Mhurr.

Belemnites canaliculatus, Schloth. (Zieten, t. xxi. f. 3.) ? The fragments we have of this Belemnite agree well with Zieten's figure of *B. canaliculatus*, which is very probably not distinct from *B. sulcatus* of Miller (Geol. Trans., 2nd Series, vol. ii. part 2, p. 59, Pl. VIII f. 3).

Loc. near Charee.

Belemnites ——— ? A nearly cylindrical fragment without a sulcus. Very like *B. elongatus* of Miller.

Loc. near Charee.

Nautilus hexagonus (M. C. t. 529) ? Flatted spheroidal, with a very small umbilicus; front approaching to flat; sides rather conical; septa 15 in a whorl; aperture wider than long; siphuncle unknown. Diameter 3½ inches, thickness 2½ inches, length of the aperture 1½ inch.

This differs from *N. hexagonus* in having a smaller umbilicus and in being more rounded. It wants the line that occurs in the middle of the front of *N. lineatus*, which it nearly resembles.

Loc. near Charee

Ammonites Herveyi, (M. C. t. 195, Zieten, 19. t. xiv. p. 3.) *var.*

This differs from the English specimens only in having a wider umbilicus. It agrees well with Zieten's figure, which differs a little from the English specimens, to which *A. macrocephalus*, figured by the same author at Tab. 5. f. 1 and 4., approaches nearer.

Loc. near Charee.

Ammonites elephantinus. Approaching to globose, with a very wide umbilicus exposing the inner whorls; whorls obtusely angular at their sides, crossed by very prominent rounded costæ, which divide into two as they pass over the front; aperture transversely elongated, gently arched. Diameter 4 inches, thickness 2½ inches, length of aperture above an inch.

Loc. near Charee.

Ammonites formosus. Discoid, with a rounded edge, umbilicate, radiated; umbilicus narrow, acutely conical; radii numerous, slightly elevated, obscure near the umbilicus, often forked near their commencement, passing in a direct course over the front; aperture sagittate, with truncated angles. Diameter 5 inches, thickness 2½ inches, length of aperture 1½ inch.

Loc. near Charee.

Ammonites lamellosus. Discoid, thick, with a rounded margin, umbilicate, radiated; umbilicus narrow, exposing a small portion of each inner whorl, smooth; radii numerous, elevated into obtuse lamellæ, commencing with a curve upon the edge of the umbilicus, often forked upon the middle of the sides, bent forward as they pass over the margin. Diameter 4 inches, thicknes 1¾ inch.

Loc. near Charee

Ammonites Opis...Discoid, compressed, with an obtuse edge, radiated; inner whorls one-third exposed; whorls slightly convex on their sides, their inner edge rounded; radii commencing with a curve at the inner edge of the whorls, numerous, prominent, rounded, often forked near the middle, slightly bent forward as they pass over the front; aperture elliptical. Diameter 4¼ inches, thickness 1¼ inch, length of aperture 1¼ inch.

Loc. near Charee.

Ammonites arthriticus. Discoid, thick, with convex whorls and a rounded margin, tuberculated and ribbed; whorls half-exposed, about 4, their inner margin smooth; tubercles large, near the middle of the sides of the whorls, about 12 in each whorl; ribs prominent, rounded, 3 or 4 from each tubercle and sometimes an intermediate one; aperture nearly circular, completed 3 or 4 times in each whorl with a thickened edge. Diameter 2½ inches, thickness 1 inch.

Loc. near Charee.

Ammonites ignobilis. Discoid, depressed, umbilicated, keeled, radiated; front rounded with a slightly prominent entire keel; umbilicus small, with squarish edges, exposing a small portion of the inner whorls; radii covering half the whorl, in pairs or forked, commencing and terminating with obscure tubercles, waved; aperture sagittate, narrow. Diameter nearly 3 inches, thickness 10 lines. Length of the aperture 1¼ inch.

Loc. near Charee.

Ammonites corrugatus (M. C. t. 451, f. 3.)? An imperfect specimen' rather more strongly ribbed than the one figured in Mineral Conchology.

Loc. near Charee.

Ammonites Armiger. Discoid, inner volutions exposed; inner whorls radiated and furnished with a row of tubercles on their sides; outer whorl with a row of tubercles near the inner edge, and a row of spines near the outer edge on each side,—the tubercles and spines connected by thick ribs; margin flat; aperture oblong, squarish. Diameter 7 inches. Strongly resembling *A. perarmatus* (M. C. t. 352.), but the whorls increase more rapidly in size, and the aperture is longer. Probably *A. Catena*, *A. perarmatus*, and this are only varieties of one species.

Loc. near Charee.

Crinoidal stems, apparently of 3 species.

Loc. near Charee.

(Fossils from the Nummulitic Limestone and Marl, Cutch, p. 321.)

Cardium intermedium. This shell, of which we have only casts, is very near in form to *Cardita intermedia* of Lamarck; the hinge, as we learn from the impression, however, wants the long marginal tooth, which marks the genus *Cardita.* Length 1 inch, width the same.

Loc. Baboa Hill.

Cardium ambiguum. The furrows upon the surface of this cast are deeper than they would be in a cast from the European *C. serratum;* which, in the general form of the shell and number of furrows it resembles more strongly than it does the *C. lævigatum* of the Indian Seas. Length 2 inches 1 line, width 1 inch 10 lines.

Loc. Baboa Hill.

Arca hybrida. Transversely oblong, oblique, longitudinally costated; costæ strongly marked with the lines of growth,—those on the anterior side, furrowed along the middle; area narrow. Length 11 lines, width 14 lines.

Nearly related to the recent *A. rhombea,* but with a narrower area between the beaks, approaching to *A. Indica* of Linnæus.

Loc. Baboa Hill.

Pectunculus Pecten. Orbicular, convex, ribbed; ribs about 30, radiating, crenated by the lines of growth; hinge-line short. Length 10 lines, width 11 lines.

Very nearly like *P. pectinatus* of Lamarck, but with more numerous and more distinctly granulated rays.

Loc. Baboa Hill.

Nucula Baboensis. Transversely oval, convex, smooth?; lunette sunk; beaks nearest the anterior side. Length ¾ inch, width 1 inch.

Nearly resembling *N. Bowerbankii* (Geol. Trans., 2d series., vol. v. 136. Pl. 8. f. 11.) but not truncated or pointed below the lunette.

Loc. Baboa Hill.

Pecten lævi-costatus. Short, smooth, radiated; radii about 20, large, equal to the spaces between them; ears large; inside furrowed. Length 1 inch 4 lines.

Length a little less than the width, but the ears enter so much into the sides that they confine the beaks into a small angle, and make the form appear more transverse than it really is.

Loc.

Ostrea callifera. (Lam. Hist. Nat. vol. vi. p. 218. Deshayes, Coq. Fossiles des Env. de Paris, vol. i. 339. Pl. LI., f. 1, 2.) ? A very ponderous shell, with only a shallow cavity for the animal. Length 3½ inches, width 2¾ inches, thickness of the shell above an inch and a quarter.

Loc. Wagé-ké-Pudda.

Ostrea orbicularis. Orbicular, plaited; both valves convex; plaits angular, repeatedly forked; surface imbricated. Length and width about two inches, resembling *O. Flabellulum*, but more regularly and finely striated. See p. 323.

Loc. Luckput.

Neritina grandis. Short-conical, smooth; spire concealed; aperture very large; base convex, its margin rounded. Diameter 3 inches, height 1½ inch.

This resembles *N. Schmidelliana*, but has a larger aperture in proportion and a less excentric apex; it is also higher. The specimen is little more than a cast, and does not exhibit the edge of the inner lip, but still it shows the attachment of the ligament projecting from the lower surface, and that the aperture occupied more than half the base.

Loc. Wagé-ké-pudda.

Globulus obtusus. Globose, with a very short spire; whorls about 6; aperture ovate-elongated, pointed above; umbilicus open, narrow. Height 1 inch, diameter the same.

The short spire of 5 whorls gives this shell a very blunt aspect.

Loc. Baboa Hill.

Turbinellus bulbiformis. Short-fusiform, smooth; spire pointed; whorls 6, flattened in the middle; aperture narrow, pointed at both ends. Height above 7 inches, diameter 5 inches.

Resembles *T. Napus*, but has a more elongated spire.

Loc, Wagé-ké-pudda.

Cypræa depressa. Obovate, with a blunt spire and a flattened space across the middle of the back. Length 3½ inches width 2 inches 7 lines.

This being only a cast, we can give but a very imperfect description.

Loc. Baboa Hill.

Nummularia acuta. Depressed, sides conical, decreasing in proportional height by age; when young radiated, when full-grown granulated; volutions and septa numerous; edge sharp. Diameter 5 lines, thickness 1½ line.

Distinguished from most other species of Nummularia by the conical form of the sides.

Loc. Luckput.

Nummularia obtusa. Irregularly orbicular, thick, smooth, sides flattened: margin rounded; volutions and septa very numerous. Diameter of the largest individual 10 lines, thickness nearly five lines. A remarkably thick species.

Loc. Wagé-ké-pudda.

Lycophris Ephippium. Orbicular, depressed, curved so as to resemble a saddle, with a gently elevated umbo on each side; margin thick, obtuse, with a narrow waved keel in the middle; grains on the surface small and equal. Diameter 1½ inch, thickness 3 lines.

Lycophris dispansus. Lenticular, thick, with a very thin, expanded, sharp-edged margin; grains on the surface largest in the centre of the disk. Diameter ½ an inch.

These two fossils may possibly be different stages of growth of the same species; for there occur along with them many curved plates which are intermediate in form. The grains on the surface are the projecting extremities of internal columns, not merely granulations in the substance of the fossil, as in some species of Nummularia. The internal structure is totally different from that of Nummularia, as it is only on the inner surfaces of the two plates that any appearance of a spiral or concentric series of cells can be traced. In p. 321 these fossils are assigned to the genus *Orbitolites.*

Loc. Both species very abundant at Baboa Hill and Wagé-ké-pudda.

Fasciolites (Parkinson) *elliptica.* Elliptical with blunt extremities, bands curved. Length 5½ lines, diameter 3 lines.

Several species of this genus occur in the tertiary formations of Europe, but they are longer in proportion to their thickness.

Loc. Wagé-ké-pudda and Baboa Hill.

Echinus dubius. Orbicular, depressed; areæ granulated, concave, and nearly free from grains along the middle; the larger furnished with two rows of tubercles near each side; the lesser with one row on each side; pores of the ambulacra in numerous, arched rows. Diameter about 3 inches, height about 1½ inch.

This has apparently imperfect tubercles, and is much longer than *Cidarites variolaris*, Brongn., which however it much resembles.

Loc. Baboa Hill and Wagé-ké pudda.

Galerites pulvinatus. Orbicular, depressed, spheroidal, covered with minute tubercles. Ambulacra obscure beneath, crossed by grooves above. Diameter 3½ inches, height 1 inch 10 lines.

A species much like *G. depressus*, Lam., but more convex and ten times the size of it.

Loc. Baboa Hill.

Clypeaster affinis. (Goldfuss, p. 134. t. 43, f. 6.)? Our specimen appears to be more orbicular than the *C. affinis* of Goldfuss, but it is too imperfect to be determined,—the posterior half being nearly all broken away. Length about 2¼ inches, width 2 inches, height 1 inch.

Loc. Baboa Hill.

Clypeaster varians. More or less obovate, hemispherical; base slightly concave in the middle; ambulacra elongated; anus transverse. Length 2½ to 3 inches, breadth 2 to 2½ inches, height 1¾ to 2 inches.

C. Bonei of Munster, (Goldfuss, 131. t. 41. f. 7.) resembles this, but is more depressed, and has a circular anus.

Loc. Baboa Hill and Wagé-ké-pudda.

Spatangus obliquatus. Gibbose; emarginate at the front; behind obovate, rather acuminated, and truncated obliquely upwards. Ambulacra deeply sunk in 3 large and 2 smaller ovate pits; base slightly convex. Length 2½ inches, width 2 inches, height 1½ inch.

Strongly resembling *S. Bucklandii*, (Goldfuss, 154, t. 47. f. 6.) it is however much larger, and has unequal ambulacra. In this and the allied species with concave ambulacra there is a reticulated band surrounding the ambulacra, which deserves attention.

Loc. Baboa Hill.

Spatangus acuminatus. (Goldfuss, 158. t. 49. f. 2.)? Our specimen is not quite so much elevated posteriorly as the figure given by Goldfuss, neither is it quite so wide; in both these circumstances it approaches to *S. lacunosus*; but it is laterally crushed, which may account for the difference. Length 1¼ inch, width nearly the same, height 10 lines.

Loc. Baboa Hill,

Spatangus elongatus. Elongated, ovate, depressed; front emarginate; base convex; ambulacra concave, with two of the rows of pores nearly central; apex excentric; mouth remote from the margin. Length nearly 2½ inches, width 1¾ inch, height 1 inch.

The two posterior ambulacra and the posterior portion of the shell are broken; the description is therefore incomplete.

Loc. Baboa Hill.

Clypeaster oblongus. (*C. scutiformis* ? Lam.) Oblong, subpentagonal, convex above, concave beneath; ambulacra very broad, obtuse. Length 2¾ inches, breadth above 2 inches, height 7 lines.

The specimen is too much mutilated to show the anus. It is more pentagonal than *C. scutiformis*, to which we have before referred it.

Tertiary Formation. Loc. Between Joongrea and Kotra.

Clypeaster depressus. Pentagonal, much depressed; ambulacra oval; anus very near the margin. Length in the oldest individual about 2 inches, breadth rather less, height about ½ inch.

This differs from *C. Laganum* in the position of the anus, which in that species is half-way between the mouth and the margin, in the greater size of the papillæ, and in being much thinner.

Tertiary Formation. Loc. Soomrow.

(Fossils from the Tertiary Formations, Cutch.)

Serpula ? recta. An oval, free, slightly-waved shelly tube, which we have provisionally called a *Serpula*, although it is more like the tube of a *Teredo;* but it appears to have been formed in loose sand. Diameter ¾ inch.

Loc. near Kotra.

Siliquaria Grantii. Spirally striated; striæ crossed by numerous cracks; fissure composed of a series of oval pores. It differs from the recent *S. anguina* only in the smallness of the pores which form the fissure.

Loc. Borders of the Runn.

Balanus sublævis. Subcylindrical with curved valves, nearly smooth. Operculum? Diameter 1 inch, height 9 lines. Parasitic upon shells.

Loc. Soomrow.

Corbula trigonalis. Trigonal, with the front rounded, gibbose, antiquated; valves nearly equal, posterior side truncated obliquely with a carina upon each valve, and pointed; umbones equal, central. Length 6 lines, width 8 lines; but these proportions vary.

Loc. Borders of the Runn.

Corbula rugosa. (Lam. vol. v. 497.) This differs from the last in being a much wider shell, with more regular and prominent laminæ upon the surface. Length 2½ lines, width 3½ lines.

Loc. Borders of the Runn.

Tellina exarata. Ovate, compressed, ornamented with many erect concentric laminæ; the posterior extremity pointed, much bent. Length nearly ¾ of the width, which is nearly 2 inches.

Strongly resembling *Tellina virgata*, (Lam. Hist. Nat. vol. v. 52.) but wider and more bent.

We have ventured (contrary to our usual custom) to complete the surface of this shell, although much has been lost from the specimen.

Loc. Soomrow.

Venus granosa. Obovate, truncated, posteriorly convex, ornamented with erect concentric laminæ, crossed by numerous striæ which cut these (near the margin) into rounded grains; lunette broad, pointed, convex; beaks nearest the anterior extremity. Length 1¼ inch, width more than 2 inches.

This belongs to the same family of *Venus* as *V. Corbis*, and *V. puerpera*, and is scarcely distinguishable from *V. puerpera*, *β*. (Lam. Hist. Nat. vol. v. 585.)

Loc. Soomrow.

Venus cancellata. Obovate, approaching orbicular, gibbose, ornamented with erect concentric laminæ, and many longitudinal striæ ; lunette wide, pointed, convex ; beaks nearest the anterior extremity. Length 1¾ inch, width 1 inch 11 lines.

This resembles the last, except that it is rounder, with thinner laminæ, which are not cut into round grains.

Loc. Soomrow and Kotra.

Venus non-scripta. Tranversely oval, convex, smooth, concentrically undulated ; lunette elongated, pointed, concave ; beaks nearer the anterior extremity. Length 1 inch 4 lines, width 1¾ inch.

A smooth and thin shell, with little of the aspect of a Venus.

Loc. Soomrow.

Pullastra ? virgata. Transversely oval, elongated, decorated with smooth concentric ridges ; beaks nearest the anterior extremity. Length 13 lines, width 1 inch 7 lines.

Several recent species of *Pullastra* are like this, but no described one appears to be identical with it.

Loc. Soomrow.

Cardita intermedia, (Lam. Hist. Nat., vol. v. part 1. 23. Brocchi. vol. ii. 520. t. 12, f. 15.) ? This strongly resembles several species of *Venericardia*, Lam.

Loc. Soomrow.

Cardium triforme. Orbicular, ventricose, longitudinally striated ; anterior side covered with round granules formed by decussating striæ ; the posterior side crossed by oblique sets of reflected ridges. Length and width 1 inch 4 lines.

Somewhat resembling the recent *Cardium æolicum.*

Loc. Soomrow.

Arca radiata. Transversely elongated, oblique, rather convex, radiated ; radii elevated, furrowed ; beaks almost close, nearest the anterior side.

Length, 7 lines, width 1 inch.

Loc. Soomrow.

Arca tortuosa ? Linn. This is only a fragment, and what there is, seems to differ from the recent *Arca tortuosa* in the degree of curvature,

Loc. Soomrow.

Pecten Somrouensis. Obovate, convex, radiated; radii about 24, squamose, subdivided, in one valve into 3, in the other into 5: ears unequal, striated, and squamose. Length 2 inches 2 lines, width nearly 2 inches.

In form this *Pecten* approaches to *P. varians*, but in the structure of the surface it is like *P. plebeius* of the Crag, and many recent species.

Loc. Soomrow.

Pecten articulatus. Orbicular, with pointed beaks, depressed, radiated; radii about 28, simple, rounded, crossed by distant scales; ears large, striated, and squamose. Length in an old specimen about 1 inch 8 lines, width 1 inch 6 lines.

The radii when the scales are worn off appear jointed.

Loc. Bank of the Runn.

Gryphæa globosa, (M. C. t. 392, *Ostrea vesicularis*, Lam. Hist. Nat. vol. vi. part 1. p. 219. Cuv. and Brongn. Env. de Paris, 383, t. 3. f. 5.

Podopsis gryphæoides, Lam. Hist. Nat. vol. vi. part 1. 195).

This exactly agrees with old specimens found in the chalk of Norfolk.

Loc. Kotra.

Ostrea angulata. Suborbicular, arched, compressed, plaited; plaits angular, numerous, branched towards the margin; laminæ of increase regular, distant, raised at their edges. Length about 1¼ inch, width the same.

Loc. Kotra.

Ostrea Flabellulum, (M. C. t. 253 Lam. Hist. Nat. vol. vi. part 1. 215. *Chama plicata*, Brander, 84 and 85.). The identity of this oyster with the *O. Flabellulum* of the tertiary formations of Europe is unquestionable.

Loc. Cheeosir.

Ostrea tubifera. Orbicular; laminæ of increase thick, raised into a few large, nearly erect tubes arranged in about 6 rows. Diameter 2 inches.

Loc.

Ostrea Lingua. Much elongated, smooth, approaching to even; upper valve flat or concave, the other very convex; squamoso-fimbriated at the edges. Length 2½ inches, width 1½ inch.

So variable are *Ostreæ* in form and so much do the species resemble each other, that it is hardly possible to define some of them clearly. That before us is very like *O. tenera* (M. C. t. 252, f. 2 and 3.), yet in the depth of the attached valve it approaches to *O. Meadii* (M. C. 252, f. 1 and 4.), but is not waved like that.

Loc. near Joonagrea and Kotra.

(Fossils from the Tertiary Formations, Cutch.)

Bulla lignaria, Linn. This agrees perfectly with the recent species as far as we can ascertain from specimens which are not perfect; but it is quite distinct from both the fossil shells described by Deshayes under the same name.

Loc. Soomrow.

Natica obscura. Globose, umbilicate; spire small, pointed; whorls about 5, convex, flattened, and ornamented at the upper edge with fine diverging plaits; umbilicus partly filled with a semi-cylindrical, obliquely-truncated callus. Height 1¼ inch, diameter the same.

Nearly related to *N. Epiglottina*, Lam., but distinguished by the flattened upper margins of the whorls; and to *Nerita canrena* of Brocchi, vol. ii. 296.

Loc. Soomrow.

Natica callosa. Obliquely depressed; spire small, hardly projecting; umbilicus covered by the thickened and expanded inner lip: aperture very large. Height 2 inches, diameter 1¾ inch.

A very distinct species.

Loc. Soomrow.

Globulus? anguliferus. Oblong, obliquely striated: spire produced; whorls about 4, with their sides and upper edges flattened; umbilicus open, rather large. Height and diameter ¾ inch.

The elevated lines or striæ advancing towards the aperture as they descend the sides of the whorls form a peculiar character. The aperture appears to be small.

Loc. Borders of the Runn.

Solarium affine. Convex above, flattish beneath, marked with diverging striæ on both sides; whorls 4 or 5, with a deflected entire carina, above which are 4 furrows placed at nearly equal distances, and below, 2 furrows near the carina, and 2 near the umbilicus, which is large, with a crenated edge. Diameter 1½ inch, height ½ inch.

Perfectly distinct from *Solarium perspectivum*, which it somewhat resembles.

Loc. Soomrow.

Trochus cognatus. Conical with straight sides; whorls numerous, ornamented with several rows of granules, which sometimes (especially towards the apex) are united by elevated lines, and a row of tubercles upon the inferior edges of the upper whorls, succeeded by 2 rows upon the middle volutions, and crenated ridges of slight elevation on the rounded border of the lowest whorls ; base flat, concentrically furrowed, containing a thick plait within

Like *T. maculatus* ; height 2 inches, diameter of the base nearly the same.

Loc. Soomrow.

Turritella angulata. Turrited, conical ; whorls convex, decorated by about 7 carinæ, of which the lowest but one is much the most prominent. Height 1⅓ inch, diameter 8 lines.

Loc. Soomrow.

Turritella assimilis. Turrited, whorls convex, ornamented with 6 or 7 carinæ, of which 2 or 3 are obscure, the 2d and 5th being prominent. Height 1¼ inch, diameter 5 lines.

A smaller, narrower species than the last.

Loc. Soomrow.

Terebra reticulata. Subulate ; sides of the whorls flat, cancellated ; a narrow upper portion of each whorl divided from the lower in the form of a band by a ridge and furrow ; beak short, curved.

In some specimens the transverse or spiral lines are less conspicuous, particularly on the band and the upper half of the whorl.

Loc. Soomrow.

Cerithium rude. Subulate, with curved sides, ribbed and furrowed ; ribs numerous, cut across by about 5 square furrows, of which the uppermost is distant from the suture ; whorls 10 or 12, nearly flat, with an obtuse varix between each—the last varix very prominent ; aperture nearly round, with a canal at the upper angle ; inner lip thick, with a callus at the top ; beak broken. Height 2 inches 8 lines, diameter about 8 lines.

Loc. Soomrow.

Cerithium corrugatum. Subulate, ribbed and coarsely striated ; ribs numerous, arched, and prominent, crossed by deep striæ ; whorls 8 or more, rather convex, with a distinct varix upon each.

This has much of the contour of an elongated Fusus. The lip and beak are wanting in the only specimen found.

Loc. Soomrow.

Fusus? granosus. Short-fusiform, ribbed ; ribs about 12 upon each whorl, divided into grains by 6 or 7 transverse ridges, convex ; spire half the length of the shell ; beak suddenly contracted. Height 4 lines.

A pretty shell, much resembling some species of *Nassa* which occur in the Crag.

Loc. Soomrow.

Fusus læviusculus. Short, fusiform, ribbed, and striated; ribs irregular, mostly very short; whorls 6, angular; base conical; beak short. Height 10 lines, diameter 5 lines.

Loc. Soomrow.

Fusus nodulosus. Fusiform, elongated, ribbed and strongly striated; ribs short, broad, about 8, in the middle of each whorl; whorls 6 or 7, concave above, convex below; beak contracted.

Loc. Soomrow.

Fusus (*Murex* ?) *hexagonus.* Short-conical, with an elongated beak, 6-angled; whorls about 6, with 6 ribs on each, which form the angles of the spire, and are crossed by 3 strong ridges upon the spire, thickened where they cross, convex; beak suddenly contracted.

Loc. Soomrow.

Ranella Bufo. Conical, with 2 rows of thin expanded varices and several ribs, the whole crossed by 3 or 4 prominent and several intermediate thin ridges; whorls 7 or 8, convex; varices obtuse at their edges; aperture oval; beak short, oblique. Height 1 inch 4 lines, diameter 1 inch.

Nearly resembles *Ranella bituberculata* of Lamarck.

Loc. Soomrow.

Rostellaria rimosa, (M. C. 91. f. 4, 5, 6, *Strombus cancellatus*, Lam. Hist. Nat. vol. vii. t. 212 ?)

The fragment we have before us, is firmly imbedded in the stone, and we are not able to clear the lip so as to ascertain whether it be striated like the lip of the recent *Strombus cancellatus*, Lam., or smooth and thickened as in *Rostellaria rimosa* and *R. Fissurella*, Lam., &c.; of all these, the species nearest to the fossil is *R. rimosa* of the London Clay, which is easily distinguished from *R. Fissurella*, Lam., of the Paris Basin, by being striated all over, and having the canal continued nearly to the apex of the spire, but not curved back. From *Strombus concellatus*, Lam., this fossil is distinguished by having a tumid varix upon the last whorl, a character also of *Rostellaria rimosa*, and we are consequently induced to refer the Cutch shell to it rather than to *Strombus cancellatus*.

Linnæus and his immediate followers did not distinguish between the recent and fossil shells, although the recent one (*Strombus decussatus*, Lam.) has the lip striated within, and is placed by Lamarck in another genus, while Deshayes in the "Coquilles fossiles des environs de

Paris," unites the French fossil and the two English ones under one name, although they are perfectly distinct; probably he has not examined English specimens. We find the characters very constant, and easily observed when once pointed out. The analogous shells of Bordeaux are equally distinct. About the same size as *R. rimosa*, M. C., from Barton.

Loc. Soomrow.

Rostellaria rectirostris. (Lam. Hist. Nat. vol. vii. 192.) The elongated form induces us to refer this fossil to the recent *R. rectirostris*, in preference to any other species.

Loc. Soomrow.

Strombus deperditus. Turbinate, tuberculated, and transversely striated ; tubercles united by a slight carina gradually increasing in size ; lip thickened, produced above into a short pointed lobe. Height 2¼ inches, diameter 1 inch 4 lines including the wing.

Much like *Strombus Gallus*, Linn., and *S. bituberculatus*, Lam., but the tubercles are of an equal size on the last whorl and not much larger than on the spire. The aperture is not much dilated, so that the wing is rather small. It appears to be a very common shell in the Runn, but perhaps there are several species, as many of the specimens are so firmly attached to the stone, and so much concealed, that the distinguishing marks cannot be traced.

Loc. Soomrow.

Strombus nodosus. Turbinate, elongated, tuberculated, transversely and longitudinally striated ; tubercles equal, numerous, prominent, obtuse. Height 1¾ inches.

Distinguished by the rounded tubercles, of which there are about 12 to each whorl – and the elongated spire.

Rare - we have seen but one specimen and that is very imperfect.

Loc. Soomrow.

Cassis (*Cypræcassis*, Stutchbury,) *sculpta.* Ovate, transversely sulcated ; aperture narrow, the outer lip plaited, the inner smooth. Height 1¾ inch, diameter 1 inch.

Strongly resembling *Cassis* (*Cypræcassis*, Stutchbury,) *Testiculus* (*Bucc. Testiculus*, Linn.), but smoother, and with a narrower aperture.

Loc. Soomrow.

Turbinellus affinis. Subfusiform, swelled in the middle, ornamented with many transverse ridges and a row of flatted tubercles near the upper margin of each whorl ; beak produced transversely, ribbed ; columella 5-plaited. Height 4 inches, width 2 inches.

Very nearly related to *Turbinellus Scolymus*, Lam., but it is more elongated, has smaller tubercles, and 5 not 3 plaits on the columella.

Loc. Soomrow.

Mitra scrobiculata. (Brocchi, vol. ii. 317. t. iv. f. 3.) ? This is the same as the fossil found at Piacenza.

Loc. Soomrow.

Mitra fusiformis. Fusiform, pointed, striated; striæ distant, deep, punctated, suture entire; columella with 4 plaits. Height 2 inches, diameter 9½ lines.

Somewhat resembling *Mitra adusta* of Lamarck.

Loc. Soomrow.

Volupta jugosa. Fusiform, pointed, transversely striated, costated; costæ many, rounded, terminating in points above the suture; aperture elliptical, elongated; columella with 3 plaits. Height 2½ inches, diameter 1¼ inch.

This differs from *V. Magorum* of Brocchi, in the form of the ribs, and the small number of plaits upon the columella, and from *V. costata*, (M. C. t 290.) in the form and in the greater number of the ribs.

Loc. Soomrow.

Voluta dentata. Turbinate, striated, spire short, conical, pointed; whorls crowned with tubercles which surround a concave space; aperture elongated; the outer lip thick, crenato-dentated within. Height 1 inch 7 lines, diameter 1 inch.

Loc. Soomrow.

Cypræa humerosa. Obovate, depressed with 3 protuberances upon the back, and one on each side. Length 2 inches, width 1½ inch.

Loc. Soomrow.

Cypræa Prunum. Oval, ventricose; aperture narrow, slightly curved with about 20 teeth on each side; base convex; beak small, not much produced; a very even shell. Length nearly 2 inches, width 1¼ inch.

Loc. Eyerau.

Cypræa digona. Ovate, ventricose, slightly depressed; base flattened on each side; beak expanded, prominent, with sharp edges; teeth on each side the aperture, above 20. An obscurely-marked species. Length 13 lines, width 9½ lines.

Loc. Soomrow.

Cypræa nasuta. Ovate-elongated, ventricose; beak projecting, large; posterior extremity of the lip produced; apex of the spire sunk. Length 10 lines, width 6 lines.

Loc. Soomrow.

Terebellum obtusum. Ovate, much elongated; spire 2 or 3 whorls, obtuse.

Length about 2 inches, width 6 lines.

This is more like the recent *T. subulatum* than the fossil *T. fusiforme.*

Loc. Soomrow.

Oliva Pupa. Elongated, subcylindrical, with a produced pointed spire, a broad smooth band at the base, and a slightly-plaited callus on the columnella. Length 1 inch 9 lines, width 8 lines.

Loc. Soomrow.

Conus brevis. Short-conical; spire flat, with a produced apex marked with 4 concentric striæ decussated by the lines of growth; base ornamented with several small, rather distant ridges. Height 1¼ inch, diameter 1 inch.

Imperfect specimens are found, more than double the above diameter.

Loc. Soomrow.

Conus militaris. Conical, elongated, slightly contracted towards the edge of the spire, coloured by many triangular spots arranged in zigzag rows; spire flat, upper surfaces of the volutions concave; base nearly smooth. Height 1½ inch, diameter 11 lines.

This shell and the following retain traces in a remarkable manner of the original colouring.

Loc. Soomrow.

Conus catenulatus. Conical, elongated, coloured with transverse rows of white spots upon a dark ground—spire flat, elevated in the middle, concentrically striated, mottled with white, the edge sharp; the base obscurely furrowed. Length 1¼ inch, width 8 lines.

Loc. Soomrow.

Conus marginatus Conical, much elongated; spire conical, short, surrounded by an obtuse ridge from its base to its apex; base of the shell striated. Length 1½ inch, width 8 lines.

Loc. Soomrow.

IX.—*On certain Meteorological Phænomena in the Ghâts of Western India.*[*]—*By Col.* Sykes, *F. R. S.*

In the proceedings of the Physical Section at the meeting at Newcastle, the incidental mention of the annual fall of very many feet of rain in certain localities of India, instead of a few inches, as is the case in Europe, caused, I was told, some surprise, and the expression of a doubt whether the fact had been ascertained with sufficient precision, and by competent persons. I was not present on the occasion alluded to, but the doubt having been brought to my notice subsequently, I lost no time in applying to a friend to procure for me the official meteorological records kept by order of the government of Bombay at the convalescent station of Mahabuleshwar, which records I knew would afford sufficient evidence to remove all doubts, at least so far as related to one locality; and I have now the pleasure of submitting the abstract of the Meteorology for 1834; the observations being made by Dr. Murray, the medical officer in charge of that station. The station is situated lat. 7° 58′ 53″ N. and long. 73° 29′ 50″ W., near the western scarp of the Ghâts, or mountain chain extending from Surat to Cape Comorin, and varying from 1000 to 8000 feet in height. The elevation of the table-land at Mahabuleshwar averages 4500 feet. The temperature of a spring is 65·5 Fahr., and the mean temperature of the air for three or four years is nearly the same. There is a good deal of forest along the Ghâts, but in belts and patches, so that the wood can have little effect on the phænomena which I am about to describe. In this table-land is the source of the celebrated Kistnah river, which runs across the peninsula.

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[*] From the Report of the Ninth Meeting of the British Association for the Advancement of Science for 1839.

The following table shows the state of the thermometer, fall of rain, &c., at the station:

Months.	Mean Temperature.	Mean Maximum.	Mean Minimum.	Mean Variation.	Fall of Rain in Inches.	Direction and force of the Wind. A. M.	Direction and force of the Wind. P. M.
January......	65·7	71·2	60·2	11·	—	E. light.	E. N. E. & W. light.
February......	67·5	73·7	61·3	12·4	0·25	E. N. E. light.	W. N. W. light.
March........	74·0	81·7	66·4	15·3	—	N. E. light.	W. & N. W. fresh.
April........	74·4	82·2	66·7	15·5	Two light showers	N. E. light.	W. light.
May..........	73·9	80·6	67·3	13·3	0·16	W. N. W. & S. W. fresh.	W. N. W. & S. W. fresh and strong.
June........	66·3	69·3	63·4	5·9	32·03	S. W. high & fresh.	S. W. high & fresh.
July...... ...	64·9	66·6	63·2	3·4	118·60	S. W. strong.	S. W. strong.
August.......	65·3	66·9	63·8	3·1	75·31	S. W. high.	S. W. high.
September....	65·0	66·4	63·6	2·8	65·97	S. W. fresh.	S. W. fresh.
October......	65·5	69·4	61·7	7·7	9·29	N. E. fresh.	N. E. & S. W. light E. N. E. fresh.
November....	63·5	69·5	57·5	12·0	—	E. N. E. high.	E. N. E. fresh.
December....	62·3	68·4	56·2	12·2	One light shower.	E. N. E. fresh.	E. N. E. & W. light.
Mean..	67·3	72·1	62·6	9·5	302·21		

Hence it appears that the mean temperature of 1834 was 67·3 Fahr., that of the hottest month (April) 74·4, that of the coldest month (Dec.) 62·3; the mean maximum (April) 82·2, and the mean minimum (Dec.) 56·2. The mean variation was greatest in April, 15·5, and least in September, 2·8; and the mean variation for the year was only 9·5. The fall of rain was prodigious, being equal to 25 feet 2 inches, and this enormous mass of water fell almost entirely in the months of June, July, August and September. General Lodwick, late president at the court of Sattarah, who transmitted to me the official register, says, "I send to you a copy of Dr. Murray's meteorological table. The inches of rain are no less than 302·21. This will astonish the philosophers, but it would do more than astonish them, had they the opportunity of seeing and hearing the rain fall in torrents through a dense fog or mass of clouds which lie upon the ground for perhaps six weeks together, with a temperature by no means cold, and with little variation." The excessive fall of rain along the line of the Ghâts does not seem to be incompatible with health, for the military detachment stationed permanently at Mahabuleshwar is not characterized by any unusual sickness; and the statistical returns of the population on the hills are as healthy as those of the table-lands to the eastward. It now remains to notice some striking facts on the western side of the peninsula. The quantity of rain that falls differs exceedingly between the coast, the Ghâts within fifty miles of the coast, and the table-land eastward of the Ghâts. The mean at Bombay is 80·69. Dr. Murray shows a fall in the hills, at the elevation 4500 feet, of 302 inches, and my records at Poonah give a mean annual fall of 23·43 inches. The solution of the causes of the anomalous fall of rain does not offer any considerable difficulties. The enormous mass of vapour taken up from the Indian Ocean on approaching India, does not appear to have its upper surface at a greater elevation than five or six thousand feet, while the stratum is of great thickness; and I can bear testimony to its lower surface being below fifteen or eighteen hundred feet. The temperature of the air over the equator is necessarily very high, and its capacity for the support of aqueous vapour is proportioned to its temperature. The vapour is converted into rain, as it is driven into air of lower temperature; and, as the temperature gradually lowers proceeding to the north, and approaching the land, it follows, that out at sea, and along shore, with equal supplies of vapour, a less quantity of it would be converted into rain eastward. With respect to the prodigious fall at Mahabuleshwar and along the Ghâts, it may be accounted for by the supposition that the monsoon vapour being of low elevation and high temperature, is driven against the mural faces, and up the chasms of the Ghâts, into higher regions, and into a colder atmosphere, and is thus immediately converted into rain. The paucity of rain forty or fifty miles eastward of the Ghâts, results from the comparatively small quantity of vapour which escapes from the cold belt of air through which it is forced to pass in the hills.

X.—*Proceedings of the Madras Literary Society and Auxiliary of the Royal Asiatic Society.*

Thursday Evening, 1st October 1840.—A. D. CAMPBELL, ESQ., *President of the Committee of Papers, in the Chair.*

The following works, presented to the Society, were laid before the meeting, and thanks voted to the donors:—

Journal of the Royal Asiatic Society of Great Britain and Ireland, No. 11—By the Society.

Journal of the Asiatic Society of Bengal, No. 15—By the Society.

The India Journal of Medical and Physical Science, No. 57—By the Editor

The India Review and Journal of Foreign Science and the Arts, No. 53—By the Editor.

The Chinese Secret Triad Society of the Tien-ti-Huih, 22 copies—By the Royal Asiatic Society of Great Britain and Ireland.

Thursday Evening, 5th November 1840—J. CADENHEAD, ESQ. *in the Chair.*

The following works, presented to the Society, were laid on the table, and thanks voted to the donors:—

The Vishnu Purana, 4 copies—By the Madras Government.

Journal of the Asiatic Society of Bengal, Nos. 16 and 17—By the Asiatic Society.

Corbyn's India Review and Journal of Foreign Science and the Arts, for September and October 1840—Nos. 54 and 55—By the Editor.

Corbyn's India Journal of Medical and Physical Science, Nos. 58 and 59—By the Editor.

McClelland's Calcutta Journal of Natural History, Nos. 2 and 3—By the Editor.

The Chinese Repository for May and June 1840—By the Editor.

Thursday Evening, 3d December 1840—*Doctor* R. WIGHT, *in the Chair.*

The following works, presented to the Society, were laid on the table, and thanks voted to the donors :—

Journal of the Asiatic Society of Bengal, No. 18—By the Asiatic Society.

The India Journal of Medical and Physical Science, No. 58—By the Editor.

The India Review and Journal of Foreign Science and the Arts, No. 55—By the Editor.

The Chinese Repository, Nos. 9 and 10, January and February, 1840—By the Editor.

Horary Meteorological Observations made agreeably with the suggestions of Sir John Herschel,

1*st.—At the Madras Observatory on the* 21*st September* 1840.

1840.	Time.	Barometer.	Thermometer.		Direction of wind.	Remarks.
			Dry.	Wet.		
Sept. 21	6 A.M.	29,864	79,2	0,6	S S W	Breeze wind, cloudy.
	7	29,876	79,7	0,4	S W	Do. do. zenith clear
	8	29,900	81,7	0,7	S E	Do. do. do.
	9	29,912	83,8	2,9	S	Fresh wind, do.
	10	29,900	85,3	4,6	W	Do. do. flying clouds.
	11	29,898	86,4	6,5	W	Do. do. do.
	12	29,864	88,2	8,7	W	Do. do. do.
	1 P.M.	29,834	87,5	7,1	E	Do. do. do.
	2	29,810	88,0	6,5	E	Do. do. do.
	3	29,790	87,1	5,6	S E	Strong wind do. and thunder.
	4	29,818	83,2	6,2	N N W	Cloudy and very loud thunder with drizzling rain.
	5	29,778	79,6	3,6	S W	Cloudy.
	6	29,804	80,0	2,7	——	Calm, clear.
	7	29,815	80,2	2,2	S E	Very clear.
	8	29,840	80,3	2,3	S E	Do. do.
	9	29,868	80,2	1,9	——	Calm, clear, lightning and dew.
	10	29,882	79,8	1,6	——	Do. zenith clear, do- do.
	11	29,886	80,8	2,1	——	Do. flying clouds do. do.
	12	29,870	82,3	2,8	S	Gentle wind fl. cl. overcast lightning and thunder.
	1 A.M.	29,836	79,9	1,9	S	Do. do. cloudy thunder and lig.
	2	29,834	79,9	2,3	S	Do. do. do loud thunder and vivid lightning.
	3	29,812	76,9	1,7	S	Do. do. do do. do. do.
	4	29,811	77,3	2.3	S	Do. do. do. thunder and lightng.
	5	29,820	77,0	2,6	S S W	Do. do. do.
22	6	29,832	76,9	1,1	S W	Do. do. do.
	7	29.874	77,0	1,7	——	Calm do.
	8	29,880	79,7	3,5	S W	Fresh wind do.
	9	29,876	81,0	2,3	W	Do. do. do.
	10	29,880	83,8	4,3	W	Do. do. zenith clear and some haze in south.
	11	29,870	85,1	6,1	W	Do. do. haze.
	12	29,840	86,1	7,6	W	Gentle wind, clear.
	1 P.M.	29,800	87,8	8,3	E	Gentle breeze, do.
	2	29,774	88,0	8,5	E	Do. do. do.
	3	29,764	88,2	8,2	W S W	Gentle wind, flying clouds.
	4	29,758	86,5	5,2	S W	Flying clouds.
	5	29,756	84,8	3,8	S W	Do. do. thunder.
	6	29,765	84,0	3,4	S W	Cloudy.

2d.—At the Trevandrum Observatory at the Winter Solstice 1840.

Date.	Hour.	Newman's Portable bar. corrected for temp. 32° and for capillarity.	Standard thermometer.	Depress. of wet bulb. thermometer.	Dew point.	Direction of wind.	Velocity of the wind.	Solar radiation.	Clouds, aspect of the sky and remarks.
ec. 21	6 A.M.	29·756	68·6	8·0	55·00	N.	6	No observations—On account of Actinometer being out of order.	Sky clear gentle wind.
	7	·784	68·4	8·1	54·50	do.	4		Do. do.
	8	·803	73·5	9·8	57·30	N. by E.	5		Do. do.
	9	·818	77·8	13·4	55·50	NE. by N.	5		Light clouds rising up do.
	10	·822	80·9	16.3	53·40	NE. by E.	3		Do. do.
	11	·802	82·4	17·5	52·90	NN. W.	4		Sky rather clear do.
	Noon.	·771	83·5	17·0	55·40	do.	3		Do. do.
	1 P.M.	·747	84·3	17·2	56·10	N. by E.	1		Do. wind hardly perceptible.
	2	·722	84·8	17·7	55·70	SE.	3		Do. gentle wind.
	3	·710	84·0	15·9	58·30	S.	4		Light clouds do.
	4	·709	82·8	15·5	57·60	SS. W.	3		Do. do.
	5	·722	81·5	13·7	59·40	S.	3		Do. do.
	6	·744	79·5	12·4	59·40	SS. W.	2		Zenith clear, rest cloudy, wind just perceptible.
	7	·769	78·5	10·6	61·56	W.	1		Sky clear light air.
	8	·794	75·4	9·4	60·17	ES. E.	1		Do. do.
	9	·808	74·9	9·2	60·00	SE.	2		Cumuli about horizon rest cl. do.
	10	·811	71·0	6·3	60·77	E.	2		Do. do. do.
	11	·804	69·4	5·4	60·60	do.	3		Sky clear gentle wind.
	Mid.	·792	68·9	2·0	65·73	do.	3		Do. do.
22	1 A.M.	·782	68·0	1·9	64·96	——	—		Do. calm.
	2	·766	67·0	3·9	60·62	E.	3		Do. cold wind.
	3	·748	66·3	3·7	60·24	do.	4		Do. do.
	4	·743	65·5	3·9	59·10	do.	5		Do. pleasant wind.
	5	·749	65·6	3·9	59·20	W.	3		Do. gentle wind.
	6	·777	64·9	3·8	58·60	——	—		Do. haze about horizon, calm.
	7	·792	66·2	3·8	60·00	——	—		Do. do. do.
	8	·811	71·8	7·2	60·09	N.	3		Light clouds in the zen. cum. about horizon gentle wind.
	9	·820	77·2	11·0	59·30	do.	1		Sky clear light air.
	10	·810	80·8	14·3	57·40	N. by E.	3		Sky pretty clear gentle wind.
	11	·792	82·5	13·9	60·30	NN. W.	2		Do. wind just percept.
	Noon.	·757	84·4	15·7	59·20	do.	2		Do. do.
	1 P.M.	·730	85·6	18·9	54·20	do.	2		Sky covered with light clouds do.
	2	·706	85·6	14·3	63·53	W.	5		Do. do. pleasant wind.
	3	·693	84·6	14·8	61·24	do.	3		Do. do. gentle wind.
	4	·692	84·3	14·3	61·81	do.	3		Do. do. do.
	5	·703	83·0	12·9	62·97	W. by S.	2		Do. do light air.
	6	·743	80·3	11·0	63·02	S. W.	2		Do. do. do.

No Rain.

The Instruments are the same, and situated exactly as before.

G. Sperschneider, ***Superintendent***

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY ; FOR THE MONTH OF JULY, 1840.

Days.	Barometer at			Ther. at			Wet Bulb.			Rain.		Evaporation.	Strength of wind.	Direction of Wind.			Cloudy Max.	Weather.			Remarks.
	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	Sun-rise.	Sun-set.			10 A. M.	4 P. M.	10 P. M.		10 A. M.	4 P. M.	10 P. M.	
1840	Inch.	Inch.	Inch.	o	o	o	o	o	o												
July 1	29,856	29.758	29,820	88,6	90,3	86,8	10,6	9,1	9,9	......	......	3,665	2	N W	E S E	S E	3	Clear	Clear	Clear	—lightning.
2	,840	,748	,820	87,7	90,4	86,3	8,7	10,4	5,8	......	......	......	2	W	E	S E	2	Fl. cl.	Clear	Clear	do. Rainbow to the w.
3	,878	,799	,890	88,0	90,0	88,0	8,5	8,5	6,9	......	......	......	2	S E	E N E	S E	3	Fl. cl.	Fl. cl.	Haze	do.
4	,908	,800	,892	87,9	88,8	87,9	5,5	8,6	6,0	......	0,017	......	2	E S E	E by S	S E	3	Fl. cl.	Clear	Th. hz.	do.
5	,882	—	,844	80,5	—	86,1	7,4	—	6,1	......	......	......	2	N W	—	E	5	Fl. cl.	—	Cloudy	do. [and lightning.
6	,846	,743	,818	84,4	86,0	84,4	5,0	4,5	4,3	0,105	0,024	......	2	N W	Calm	S W	4	Cloudy	Cloudy	Fl. cl.	Rainbow to the w. Th.
7	,836	,750	,812	82,8	86,4	85,3	4,3	7,4	3,3	......	......	......	2	W	W	S	4	Cloudy	Cloudy	Cloudy	lightning.
8	,842	.750	,814	83,9	85,0	84,3	4,4	5,5	4,8	......	......	3,068	2	W	Calm	S W	7	Cloudy	Cloudy	Cloudy	drizzling rain lightning.
9	,862	,790	,874	84,3	86,0	85,0	3,8	10,6	10,5	......	......	......	2,3	W N W	N W	W N W	8	Cloudy	Cloudy	Cloudy	lightning.
10	,866	,780	,852	85,7	87,8	83,8	12,2	14,0	5,8	......	......	......	3	W N W	N W	N	9	T haze	Cloudy	Cloudy	drizzling rain lightning.
11	,850	,745	,812	85,5	88,0	84,5	8,5	15,0	9,9	0,005	......	......	4	W	W	N W	9	Cloudy	Cloudy	Cloudy	lightning.
12	,756	—	,750	86,0	—	83,9	11,1	—	6,4	......	......	......	2,3	S W W	—	N	9	Cloudy	—	Cloudy	do.
13	,786	,706	,802	87,2	91,3	89,2	11,6	15,8	7,4	......	......	......	2,3	S W W	NWbyW	S	7	T. haze	Cloudy	Cloudy	Rainbow to the east.
14	,878	,750	,854	88,6	92,0	86,8	13,2	13,5	8,0	......	0,345	......	2,3	W	S E	S W	6	T. haze	Cloudy	Th. hz.	lightning. [strong wind.
15	,862	,738	,806	87,8	89,4	87,8	10,9	8,6	7,3	......	......	2,301	3	W	S S E	S	8	Haze	Cloudy	Th. hz.	Th. and lightn. very
16	,816	,690	,790	85,5	89,7	84,8	5,7	8,7	6,3	1,214	0,147	......	2,3	S W	S	S W	7	Cloudy	Cloudy	Cloudy	thunder and lightning.
17	,796	,724	,786	85,8	89,0	85,5	9,9	10,3	10,5	......	......	......	2,3	S W W	S. S E	S W	7	Cloudy	Cloudy	Cloudy	lightning.
18	,806	,684	,798	86,9	90,3	85,9	10,5	12,6	7,3	......	......	......	2,3	S W	Calm	S W	8	Fl. cl.	Cloudy	Cloudy	thunder and lightning.
19	,794	—	,786	85,3	—	82,7	6,8	—	2,1	0,557	0,035	......	2,3	S W	—	S W	8	Cloudy	—	Cloudy	lightning.
20	,770	,688	,808	83,6	88,0	82,4	6,7	4,0	4,0	......	1,392	......	2	S W	N W.	S W	8	Cloudy	Cloudy	Cloudy	do.
21	,796	,724	,810	81,7	83,2	81,7	5,5	6,2	5,2	0,467	......	......	2	S W	S. S W	S W	8	Cloudy	Cloudy	Cloudy	do.
22	,806	,722	,804	81,9	86,2	84,1	6,5	9,2	6,6	......	......	2,131	2	S W W	S W	W	8	T. haze	Cloudy	Cloudy	do.
23	,830	,710	,804	83,9	88,3	86,2	7,5	9,5	5,3	......	......	......	2,3	S W	S W	S W	8	T. haze	Cloudy	Cloudy	do.
24	,814	,690	,790	85,2	90,2	85,9	9,4	14,2	6,4		......	......	3	W	S W	W	7	T. haze	Cloudy	Cloudy	do.
25	,810	,706	,842	84,6	88,2	87,2	9,6	11,2	11,6	0.049	......	......	3	W	Calm	W	7	Cloudy	Cloudy	Cloudy	do. strong wind.
26	,874	—	,846	86,6	—	89,2	12,1	—	10,2	......	......	......	2,3	W	—	N W	7	Haze	—	Haze	do.
27	,886	,776	,850	87,7	90,8	88,6	8,4	15,8	14,3	......	......	......	2,3	W	W	W	7	Haze	Cloudy	Haze	do.
28	,858	,744	,808	87,4	91,3	86,1	12,3	12,0	5,7	......	......	......	2,3	W N W	S E	S	5	Clear	Cloudy	Clear	do.
29	,848	,733	,814	87,9	88,5	86,4	10,5	9,0	8,3	......	......	3,638	2,3	N W	S E	S	6	Clear	Cloudy	Cloudy	do.
30	,830	,718	,808	86,8	89,0	88,3	7,9	11,6	7,8	0,067	......	......	2,3	W	S E	S	5	Haze	Cloudy	Fl. cl.	do.
31	,848	,748	,850	88,4	88,0	86,2	12,0	8,5	5,2	......	......	......	2,3	W	S E	S	6	Haze	Cloudy	Fl. cl.	do.
Mean.	29,836	29,738	29,821	85,7	88,4	85,8	8,6	10,2	7,1												

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY; FOR THE MONTH OF AUGUST, 1840.

Days.	Barometer at			Ther. at			Wet Bulb.			Rain.		Evaporation.	Strength of wind.	Direction of Wind.			Cloudy Max.	Weather.		Remarks.
	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	Sun-rise.	Sun-set.			10 A. M.	4 P. M.	10 P. M.		10 A. M.	4 P. M.	10 P. M.
1840	Inch.	Inch.	Inch.	o	o	o	o	o	o											
Aug. 1	29,870	29,748	29,874	86,2	92,0	85,8	10,3	15,0	6,4	......	0,117	......	2,3	W	S S W	S	7	Haze	Cloudy	Cloudy—Thunder and lightn.
2	,878	—	,850	85,5	—	85,9	7,6	—	5,9	0,909	......	......	2,3	W	—	S W	6	Clear	—	Cloudy th. and lightn. Rainbow
3	,854	,760	,848	85,0	86,0	83,1	8,0	8,0	5,6	......	......	......	2,3	W	W by N	S W	8	Cloudy	Cloudy	Cloudy lightn. [in the evening.
4	,838	,720	,798	83,4	88,0	86,6	6,9	10,0	7,1	......	......	......	2,3	W	SWbyW	S W	6	Cloudy	Cloudy	Cloudy do.
5	,848	,734	,810	84,3	90,0	86,3	9,5	13,0	7,7	......	......	1,802	2,3	W	W by N	Calm.	6	Haze	Cloudy	Cloudy do.
6	,838	,704	,800	86,0	92,0	86,3	10,9	15,5	5,8	......	......	......	2,3	W	W S W	N W	7	Haze	Cloudy	Cloudy do.
7	,798	,700	,800	87,1	92,0	88,8	11,1	15,0	8,7	......	......	......	2,3	W	W	S E	6	Th. ha.	Cloudy	Cloudy do.
8	,858	,744	,856	86,9	93,0	88,6	7,4	16,0	7,7	......	......	......	2,3	W	W	S W	5	Th. ha.	Cloudy	Cloudy do.
9	,896	—	,856	87,2	—	87,4	10,3	—	4,4	......	......	......	2,3	W	—	S	4	Haze	—	Cloudy do.
10	,880	,748	,824	88,2	88,3	85,9	11,7	9,3	5,7	......	......	......	2,3	N W	S E E	S	3	Clear	Clear	Haze do.
11	,870	,774	,860	88,0	89,8	86,0	11,4	10,3	6,0	......	......	......	2,3	W	S S E	S	3	Fl. cl.	Clear	Haze do.
12	,890	,778	,888	86,9	89,0	86,8	9,6	8,5	6,3	......	......	3,628	2,3	N W	S E	S	5	Clear.	Clear	Fl. cl. do.
13	,912	,800	,888	87,9	88,8	87,9	8,4	7,0	6,9	......	......	......	2,3	W	S E	S	4	Clear	Clear	Fl. cl. do.
14	,908	,760	,848	86,1	90,0	87,0	7,4	10,0	5,5	......	......	......	2,3	S W	E	S	3	Clear	Clear	Th. hz. do.
15	,874	,774	,872	88,2	90,0	88,2	12,6	10,0	6,1	......	......	......	2,3	N W	S E	S	4	Haze	Haze	Th. hz. do.
16	,910	,830	,912	89,0	90,0	88,2	13,0	10,0	6,7	......	......	......	2,3	W	S E	S	4	Haze	Haze	Fl. cl. do.
17	,910	,780	,852	89,0	90,0	87,9	11,0	9,5	6,8	......	......	......	2,3	S W	S S W	S	8	Haze	Haze	Th. hz.—vivid lightning.
18	,880	,764	,836	84,9	89,4	86,4	7,4	9,6	5,3	......	......	......	2,3	N W	E	S	7	Cloudy	Cloudy	Cloudy lightning.
19	,864	,788	,882	86,4	88,2	86,8	11,0	8,7	6,5	......	......	3,026	2,3	W	E by S	S	5	Th. ha.	Cloudy	Cloudy do.
20	,890	,802	,856	86,5	89,0	85,7	10,5	9,3	5,7	......	......	......	2,3	N W	E by S	S E	5	Th. ha.	Cloudy	Clear do.
21	,896	,784	,870	87,2	88,8	87,7	9,0	9,5	7,2	......	......	......	2,3	W	E S E	S	7	Th. ha.	Clear	Fl. cl. do.
22	,876	,763	,854	87,7	89,2	86,8	8,6	9,2	7,9	......	......	......	2,3	S W	—	S	4	Fl. cl.	Clear	Cloudy drizzling rain & lightn.
23	,878	—	,850	85,3	—	86,7	5,9	—	3,1	0,437	......	......	2,3	S W	E by S	W	6	Fl. cl.	—	Clear lightning.
24	,892	,774	,922	85,5	88,0	85,1	6,5	7,0	4,7	......	......	......	2,3	W	S E	S E	7	Clear	Clear	Cloudy do.
25	,904	,783	,856	85,0	88,2	87,0	2,5	7,7	4,4	0,287	......	......	2,3	W	S	S E	4	Haze.	Cloudy	Cloudy vivid lightning.
26	,878	,743	,822	83,6	88,7	85,9	5,8	7,7	5,1	0,027	......	2,331	2,3	W	E	S E	6	Cloudy	Th. hz.	Haze lightning.
27	,854	,736	,842	85,4	88,0	87,3	6,4	7,0	5,8	......	......	......	2,3	S W	S	S	8	Haze.	Clear	Haze loud th. & vivid lightn.
28	,888	,762	,862	82,0	87,0	85,9	5,5	5,5	4,4	3,952	......	......	2,3	W	E S E	S	6	Cloudy	Clear	Cloudy do. do. do. do.
29	,866	,758	,854	83,2	86,0	84,8	4,2	5,5	3,4	2,091	......	......	2,3	N W	—	S	6	Cloudy	Cloudy	Haze lightning.
30	,824	—	,802	84,1	—	84,2	4,9	—	4,3	......	......	......	2,3	N E	S E	E	8	Cloudy	—	Haze do.
31	,800	,684	,822	84,8	86,0	82,6	4,3	5,0	4,2	......	......	......	2,3	S W	Calm	W	8	Fl. cl.	Cloudy	Rainy loud th. & vivid lightn.
Mean	29,872	29,759	29,851	86,0	89,1	86,4	8,4	9,6	5,8											

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY; FOR THE MONTH OF SEPTEMBER, 1840.

Days.	Barometer at			Ther. at			Wet Bulb.			Rain.		Evaporation.	Strength of wind.	Direction of Wind.			Cloudy Max.	Weather.			Remarks.
	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	Sun-rise.	Sun-set.			10 A. M.	4 P. M.	10 P. M.		10 A. M.	4 P. M.	10 P. M.	
1840	Inch.	Inch.	Inch.	o	o	o	o	o	o												
Sept. 1	29,810	29,690	29,826	83,0	85,3	82,9	5,1	5,3	4,4	2,181	......	......	2,3	s w	Calm	w	8	Cloudy	Cloudy	Rainy	loud thun. and vivid lig.
2	,806	,698	,816	82,8	84,4	83,9	3,8	4,6	3,5	0,769	......	1,960	2,3	s w	Calm	s	9	Cloudy	Cloudy	Cloudy	lightning.
3	,834	,730	,820	79,2	84,0	82,0	3,8	5,5	2,5	0,107	......	......	2,3	w	w by s	s w	8	Cloudy	Cloudy	Cloudy	uo.
4	,890	,770	,886	81,9	84,8	82,7	3,4	6,8	3,1	......	......	......	2,3	w	w s w	s	7	Cloudy	Cloudy	Haze	do.
5	,916	,802	,908	82,7	88,0	84,4	5,2	11,0	3,8	......	......	......	2,3	s w	s w	s e	6	Haze	Cloudy	Cloudy	do.
6	,922	—	,866	83,9	—	84,8	7,4	—	4,3	0,457	......	......	2,3	w	—	s	7	Haze	—	Cloudy	do.
7	,910	,782	,880	84,2	88,0	85,9	7,2	8,5	5,3	......	......	......	2,3	n w	e n e	s	6	Haze	Cloudy	Cloudy	do.
8	,900	,766	,852	85,6	87,7	86,3	8,6	8,7	5,7	......	......	......	2,3	w	n e	s	7	Clear	Cloudy	Fl. cl.	do.
9	,894	,784	,850	82,6	85,0	84,1	6,7	5,5	5,1	......	......	1,456	2,3	s w	s w	s w	9	Cloudy	Cloudy	Cloudy	do.
10	,866	,758	,830	81,4	82,4	81,8	2,0	3,9	3,1	......	......	......	2,3	s w	s e	s	9	Cloudy	Cloudy	Cloudy	do. drizzling rain.
11	,874	,760	,852	80,3	83,0	82,3	5,1	6,0	5,3	......	......	......	2,3	w	s e	w	8	Cloudy	Cloudy	Cloudy	do.
12	,912	,782	,860	83,6	86,0	85,2	9,1	4,5	7,6	......	......	......	2,3	sw.w	s e	s	8	Clear	Fl. cl.	Fl. cl.	do. and thunder.
13	,922	—	,882	83,0	—	84,4	8,0	—	4,6	0,417	......	......	2,3	w	—	s	8	Cloudy	—	Haze	do.
14	,868	,775	,872	84,9	86,0	85,6	—	5,0	5,2	......	......	......	2,3	w	s e	s	8	Clear	Cloudy	Haze	loud thun. and vivid lig.
15	,838	,790	,886	83,2	83,0	82,0	4,2	3,5	3,6	1,941	......	......	2,3	s w	s e	s w	8	Cloudy	Clear	Fl. cl.	do. do.
16	,886	,783	,896	83,2	83,8	83,3	3,9	5,3	3,3	1,494	......	1,723	2,3	s e	s e	s w	7	Clear	Clear	Cloudy	thunder and lightning.
17	,912	,790	,882	83,0	87,8	84,8	3,0	7,5	3,9	......	0,055	......	2,3	s	s e	s	8	Cloudy	Fl. cl.	Fl. cl.	do. do.
18	,900	,810	,896	84,2	85,7	84,3	4,7	5,4	2,9	......	0,271	......	2,3	s w	n e	s	8	Clear	Cloudy	Th. haze	do. do.
19	,902	,787	,861	84,0	85,3	83,1	4,9	5,3	1,4	......	......	......	2,3	w	Calm	s	8	Cloudy	Cloudy	Haze	do. do.
20	,920	,790	,888	81,7	84,3	82,4	3,3	4,3	2,2	0,167	......	......	2,3	s	Calm	s w	7	Th. hz.	Haze	Fl. cl.	do. do.
21	,900	,818	,882	85,3	83,2	79,8	4,6	6,2	1,6	......	0,175	......	2,3	w	n n w	Calm	6	Fl. cl.	Cloudy	Fl. cl.	loud thunder and vivid lightning at day and night.
22	,880	,758	,850	83,8	86,5	84,7	4,3	5,2	3,6	......	......	......	2,3	w	s w	e	8	Clear	Fl. cl.	Cloudy	thunder and lightning.
23	,852	,748	,854	83,4	86,1	84,0	3,4	7,8	5,0	0,072	......	1,757	2,3	w	n w	s w	7	Cloudy	Haze	Fl. cl.	do. do.
24	,872	,774	,860	85,2	86,4	84,7	7,2	6,0	3,2	......	......	......	2,3	w	e	s	8	Th. hz.	Th. hz.	Th. haze	do. do.
25	,870	,754	,832	84,2	86,8	85,7	9,2	8,3	4,3	......	......	......	2,3	w	s e	s	8	Th. hz	Cloudy	Cloudy	do. do.
26	,826	,737	,820	83,9	86,3	85,8	8,9	9,5	5,1	......	......	......	2,3	w	n w	e	7	Cloudy	Cloudy	Cloudy	do. do.
27	,816	—	,828	85,3	—	85,6	11,8	—	4,3	......	......	......	2,3	w	—	s e	7	Th. hz.	—	Th. haze	do. do.
28	,850	,740	,822	86,0	90,0	87,7	10,0	8,5	4,5	......	......	......	2,3	w	nw by s	Calm	6	Haze	Cloudy	Haze	—lightning.
29	,826	,744	,830	87,7	88,4	85,5	9,7	7,1	4,9	......	0,258	......	2,3	w	e by s	Calm	4	Haze	Cloudy	Fl. cl.	—thun. and lightn. dew.
30	.42	,734	,832	86,2	88,1	84,8	7,0	7,1	4,3	......	......	1,973	2,3	w	e. se	s	5	Clear	Fl. cl.	Clear	—lightning. dew.
Mean	29,874	29,765	29,857	83,6	85,8	84,1	6,0	6,3	4,0												

The Instruments with which the foregoing observations are made, are placed in the Western Verandah of the Honourable Company's Observatory; at about five feet above the surface of the ground, and twenty-seven feet above the level of the Sea; the thermometer was made on purpose for the Observatory, and at 75° (the only point at which a comparison has been made) it was found to differ insensibly from the Royal Society's Standard; the barometer is one of two Standards which have been lately constructed, and may be depended upon to 0,0100 an inch.

J. Crisp, Major

H. C. Acting Astronomer.

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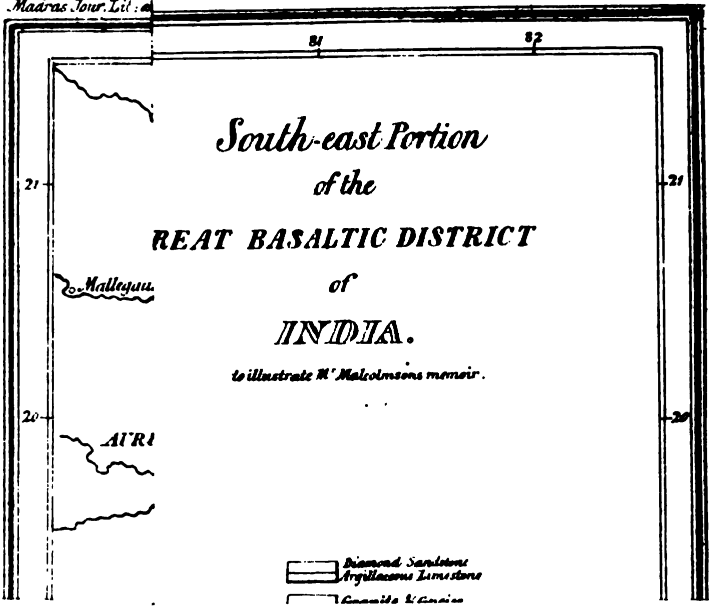
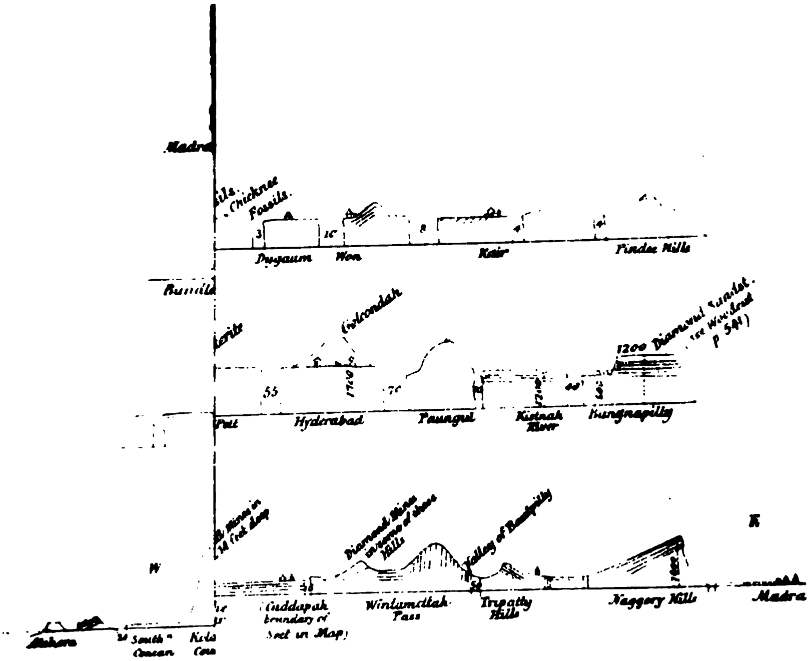
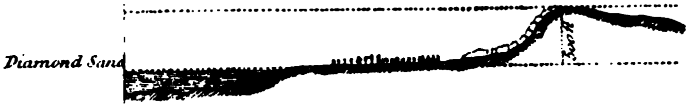


South-east Portion
of the
REAT BASALTIC DISTRICT
of
INDIA.
to illustrate Mr Malcolmson's memoir.





Schistose Beds passing into Limestone.

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